# Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 68 YEARS

A. E. KNOWLTON.....Associate Editor
HENRY G. DOOLEY.....Associate Editor
E. DALTON WHITE.....News Editor*
CHARLES DE VORE.....Assistant Editor
R. M. SHOOP.....Assistant Editor
E. M. GLENNON.....Assistant News Editor

BRANCH OFFICES
D. T. BRAYMER.....Western Editor
H. S. KNOWLTON.....New England Editor
WAYNE SNOWDEN.....Pacific Coast Editor*
GEORGE E. DOYING, JR., Washington Correspondent
L. W. W. MORROW.....Consulting Editor

*In Military Service

FRANK R. INNES.....Managing Editor
S. B. WILLIAMS.....Editor
W. K. BEARD, JR.....Publisher

April 4, 1942

## Contents

Vol. 117, No. 14

More Capacity with Little Additional Equipment.... 48
JOHN CASSIE, *B. F. Sturtevant Company*

Grand Coulee Linked to Bonneville by 230 Kv.... 52
S. E. SCHULTZ, *Bonneville Power Administration*

Control and Regulation of Utility-Industrial Ties.... 55
L. F. STONE, *General Electric Company*

Flexibility Features Underground Use of Non-Metallic Cables.... 58
H. H. MINOR and E. S. DREISCHMEYER, *Pacific Gas & Electric Company*

Out-of-Step Indicator Visualizes Asynchronism.... 61
T. M. BLAKESLEE, *Los Angeles Bureau of Power and Light*

One-Shot Treatment Speeds Office Contacts.... 63

Static Capacitors Save Investment Dollars—II.... 64
R. G. HOOKE, *Public Service Electric & Gas Company*

Appliances in Schools Build Future Demand.... 67
JOHN E. CANFIELD, *Wisconsin Power & Light Company*

Washington Comment.... 70

News of the Week.... 71

Editorials.....47 and 68
How.....79
Load Building.....108
New Equipment.....112
Manufacturing and Markets.....118
News About People.....126
Sales Opportunities.....132
Letter to the Editor.....134
Rural Allotments.....135
Index of Advertisements.....140

*The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owner.*

McGRAW-HILL PUBLISHING COMPANY, INC.
JAMES H. McGRAW, Founder and Honorary Chairman

Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada, $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Contents copyrighted, 1942, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga.

Publication Office
99-129 North Broadway, Albany, N. Y.

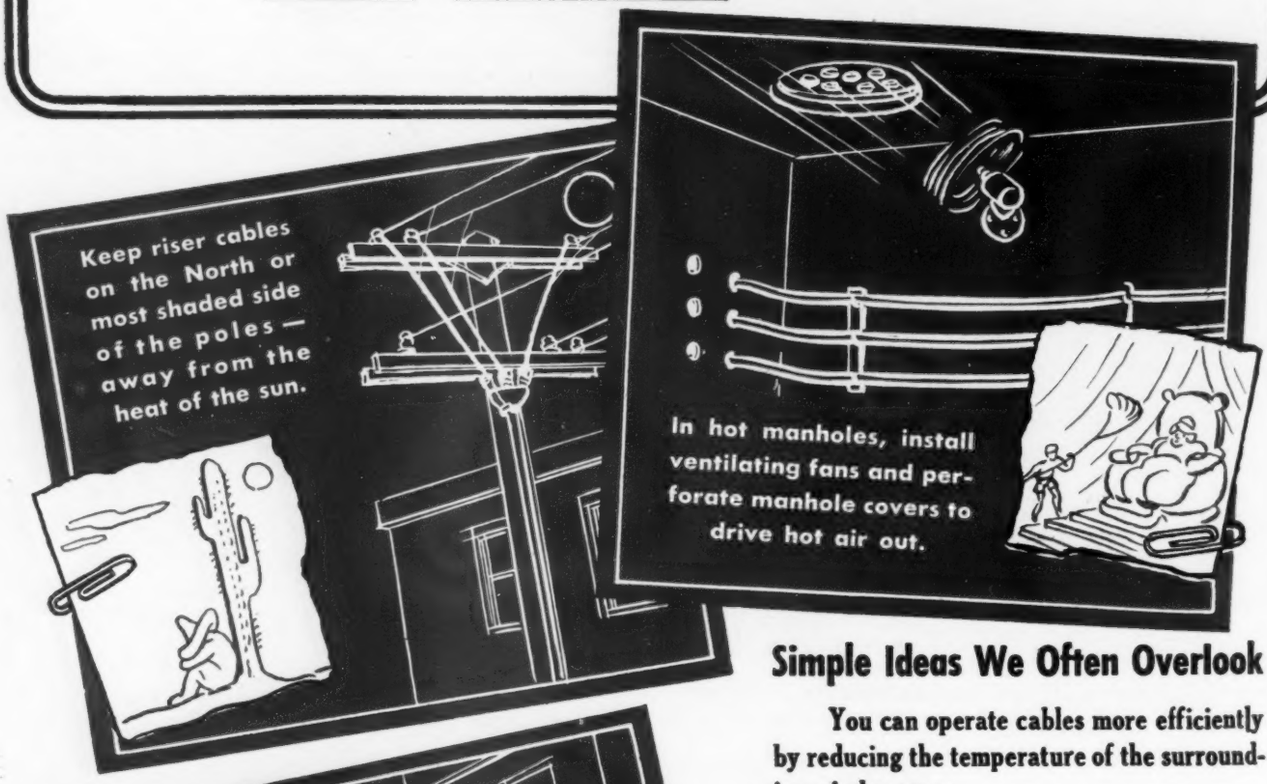
Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

JAMES H. McGRAW, Jr.....President
HOWARD EHRLICH.....Executive Vice-President
MASON BRITTON.....Vice-Chairman
B. R. PUTNAM.....Treasurer
D. C. McGRAW.....Secretary
J. E. BLACKBURN, Jr.....Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAWHILL, New York

A McGRAW-HILL PUBLICATION

# How to Make Wires and Cables LAST LONGER Outdoors . . .


Keep riser cables on the North or most shaded side of the poles — away from the heat of the sun.
In hot manholes, install ventilating fans and perforate manhole covers to drive hot air out.

## Simple Ideas We Often Overlook

**You can operate cables more efficiently by reducing the temperature of the surrounding air because:**

1. **the insulation will last longer with the same conductor load, or**
2. **more current can be carried in the same cable without shortening its life.**

**Where current carrying capacity is not a factor (as with signal and control cables), lower ambient temperatures prolong the life of any insulation—especially rubber.**

**THE OKONITE COMPANY**
***Offices in principal cities***
**Passaic, N. J.**

● Make the most of your present cables — copper, rubber, lead and other cable components are vital to our war production and must be conserved. And call on Okonite Engineers for suggestions on the best way to install, operate and maintain your electric circuits.

**OKONITE**
**Insulated Wires and Cables**

# Conversion

War requires the conversion of industry from peace to war production. If the war is to be successful that requirement must be met in measure full up and running over. There can be no holding back anywhere, no scanty effort, no grudging participation.

Conversion is an all-embracive word. It covers matters physical, mental and spiritual. Things are converted from one use, one purpose, to another. The automobile, washing machine, refrigerator, radio and other industries are converted to produce the goods of war. This is conversion of things, conversion physical. This kind of conversion can be accomplished by order. Government can decree it and it will be done—after a fashion. But such accomplishment cannot be sufficient for the job that must be done. It will not win the war. For industrial conversion to be adequate and effective, to be abundantly productive, it must result from more than a government order. It must stem coincidentally from a mental conversion, a change in ways of thinking in the minds directing industry. And that change cannot be ordered; it can result only from something closely akin to spiritual conversion—perhaps actually it is that.

What has all this preaching to do with the electric utility business? Electricity is electricity in war as in peace; the utilities don't have to convert to different production to meet the demands of war. This is fallacious reasoning; it misses the essential point. What the utilities make and sell is electric service, a product in which electricity is only a part. And this product, electric service, must be converted from a peace to a war form. Actual, physical, changes must be made in it. War-time electric service is going to be, already is in some places, a very much different thing from electric service in peace-time.

The physical conversion to a different product in the electric utility industry, like conversions in other industries, can be accomplished by government order. Not complete change all at one time. Electric service has too many aspects for that. The change will be a matter of the wise use of plenty, of granting abundance here, of allotting only sparingly there, a continuing change made piecemeal. To accomplish it, government can and will decree and enforce any condition or circumstance of electric service to be thus and so if thus and so are deemed to be necessary for successful prosecution of the war.

But maximum effectiveness of electric utility conversion to war production will not be realized from government orders alone. It will be realized only if utility management is converted to ways of thinking to produce that result. It is only human and natural that power company executives should often look upon government orders affecting electric service as just more political interference in their business. In this respect the necessity for mental conversion is a more difficult obligation on electric utility management than on almost any other business group. The utility man must not only give up many of his established habits of thinking and doing but must also overcome fears and dislikes that are only too well justified by past and present treatment.

Herein is the need for that basic conversion that comes so near to, and perhaps is, a spiritual one. Through faith alone, through a faith that promises little in future joy and content to power companies, a faith that rests on no selfish hope, utility management must see that the way of salvation for the nation lies in unreserved, wholehearted, unsparing cooperation in the tremendous job of winning the war.

# More Capacity With Little Additional Equipment

***Improving plant outputs by eliminating sources of combustion difficulties — Fan system betterments, duct system streamlining and other improvements are often attainable at nominal cost***

***JOHN CASSIE, Installation Analysis Department, B. F. Sturtevant Company, Hyde Park, Mass.***

IN MODERN steam plant practice, despite the margins of capacity designed into generating units, there are many installations where these cannot be fully utilized because the assemblies for handling the air and gases of combustion are not co-ordinated for their best performance. The reasons for such conditions are many. Analysis of discrepancies in the field is helpful in indicating means by which, and often in very limited space, code performance may be more nearly realized with nominal outlay for materials.

The selected mechanical draft fans may for example, on code test, be ample for the intended duty, but when applied to the generating unit as a whole such fans may appear deficient. The result is a departure from the full potential capacity of boilers, heat exchangers, turbines, etc.

We may profitably consider several cases from current practice:

1. One installation included a turbine-driven, double-width, double-inlet fan for induced-draft service. The transition between the air heater and the fan included in elevation a 90-deg. change of flow direction, and in plan an abrupt contraction between the air heater outlet and the inlet box entrance. The flow is about as suggested by arrows (Fig. 1). Here there were two main causes of fan capacity impairment. One was a spin imparted to the gases ahead of the impeller, producing a much more serious adverse effect on generating capacity than were the same 90-deg. elbow located in the duct work remote from the fan. With a remote elbow frictional loss causes the fan to operate at a reduced orifice on the same pressure characteristic curve, and in the case shown the pressure characteristic was affected to such an extent that the usual "elbow loss" became insignificant. The other cause, the sudden narrowing of the unit width parallel to the fan center line, produced two end contractions at the entrance to each inlet box. These gave an effect resembling that of a box with too small a dimension in the direction parallel to the shaft.

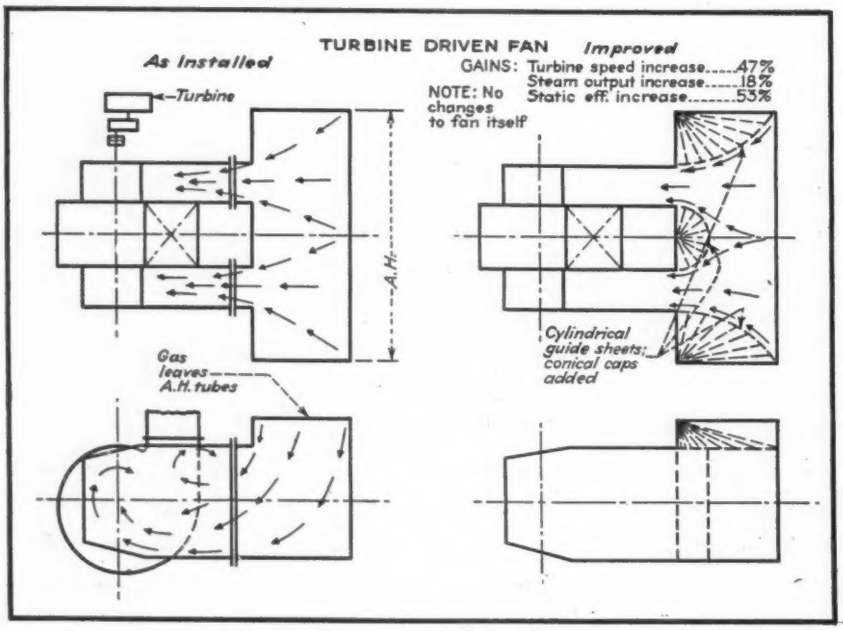



FIG. 1—Streamlining portions of duct system improved air circulation

### *Corner Turns Inadvisable*

The use of corner turns at nominal cost as guides for the flow through the 90-deg. turn at once suggested itself, but these were considered inadvisable on account of interference with air heater servicing. The alternative streamlining plan adopted (see "Improved" portion of Fig. 1) led to excellent gains in operating efficiency. The boiler rating was 102,000 lb. per hour. Before the betterment was effected, the steam delivery totaled only 88,000 lb. per hour. Under the improved layout, this rose to 104,000 lb. per hour, or 18.2 percent increase. The vertical curve sheets used offered a nozzle-like flow passage, thus utilizing the full box cross-section. No change was required in the fan itself, and the fan turbine, which had previously been fully loaded, called for no additional steam.

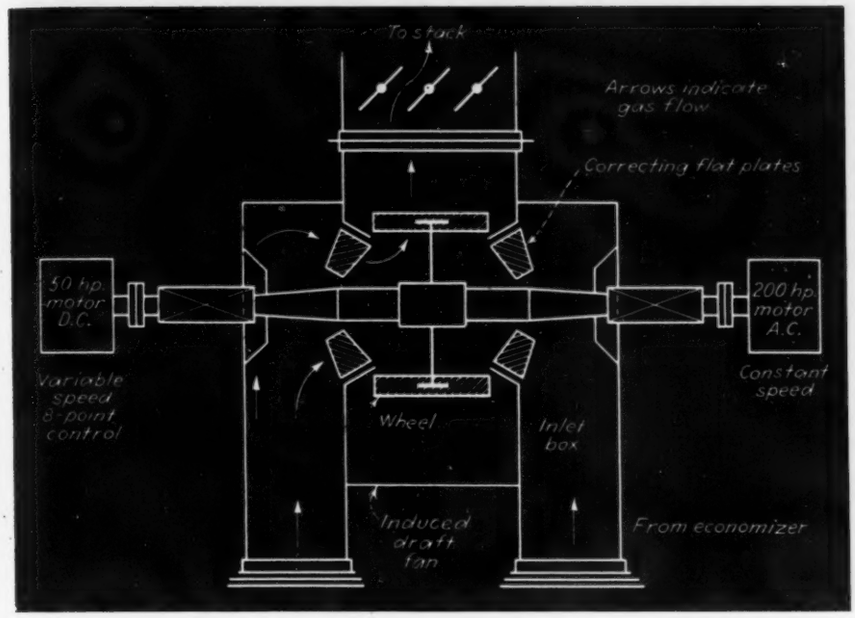



FIG. 2—Arrangement of spinning vanes to improve fan use

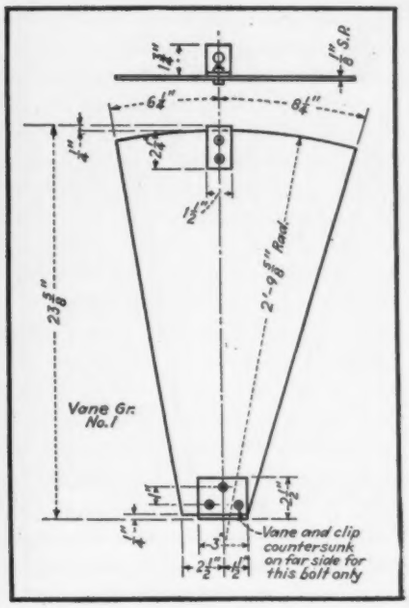



FIG. 3—Detail of spinning vane design. Plates of this type increased steam capacity 18.2 percent by improving air system

Doubts concerning the ability of the fan and its driving turbine to perform their expected duties were thus dispelled. The steam-generating capacity was actually brought above the boiler rating. The increase of 18.2 percent in steam delivery roughly corresponds to the same percentage increase in gas volume. Were this increase obtained by speeding up the fan as installed, the pressure required of the fan would rise 39 percent and the brake hp. would increase 65 percent. The simple solution adopted left the fan turbine fully loaded as before, but no more.

### *Plates Increase Steam Output*

2. In this installation in a public utility plant complaint arose from lack of steaming capacity. An induced-draft fan (Fig. 2) was driven by a 50-hp., d.c. variable-speed motor and by a 200-hp. constant-speed a.c. motor. The boiler rating was about 165,000 lb. of steam per hour. When the control of the 50-hp. motor reached the fifth point (of eight total) the motor was loaded to its rated capacity and only 125,000 lb. of steam per hour was produced by the boiler. For additional steam output the fan load was then thrown upon the 200-hp. motor, while the fan discharge damper was largely closed. Upon opening this damper to still further increase the steam output, it was found that the motor rating of 200 hp. was reached at 138,000 lb. per hour delivery. At this condition the fan discharge damper was still closed sufficiently to maintain several inches positive pressure "upstream" from the damper. This was manifested in a manometer reading at that location, which led to the discovery of the trouble.

It appeared that at any speed the fan wheel was too powerful for the driving motor. Also, when utilizing the 200-hp. motor it was found necessary to waste several inches of pressure, developed by this too-large fan, in a drop across this damper in order to prevent motor overload. The installation of a series of flat steel plates (Fig. 3) in the wheel inlet cones gave the equivalent of substituting a smaller wheel. This was accomplished by so adjusting the angle at which these plates were set (relative to plane of the fan wheel center line) that the gases entering the wheel flowed in the direction of wheel rotation.

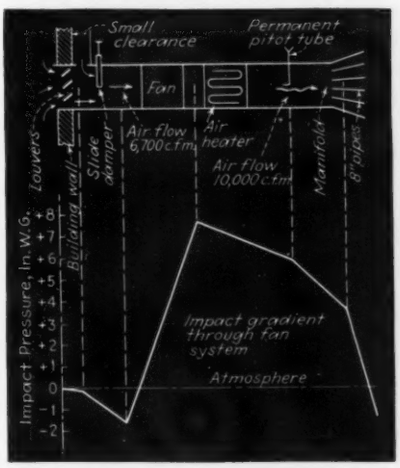



FIG. 4—Chart of impact gradient through fan system indicating effects of poor clearance

### *Adjust Angle of Plates*

By adjusting the angle of these plates, rather than the angle of the discharge dampers, a given volume of gas was handled at a considerably lower horsepower. The volume originally handled was thus considerably increased before the 200-hp. rating of the motor was reached after installing the flat plates. It was decided that 10 percent overload above the motor nameplate rating was not objectionable, especially as this would occur only at times of short duration emergency. For this reason these flat plates were adjusted to draw 220 hp. from the motor. When thus set, a steam output of 165,000 lb. per hour was obtained. This increase in maximum steam output from 138,000 to 165,000 lb. per hour on each of six such units in the station represented the equivalent of adding 1.2 steaming units as originally installed.

Such a procedure, even in normal times, would have been worth while, but under present conditions it was most valuable. The correction required the use of only about 0.25 ton of steel per boiler. No critical mate-

rials and no substantial labor were required, nor any building extension, new boiler, fan or air heater. No question of delays in the supply of material arose, which might have required many months' waiting under present conditions. The whole betterment was handled in a few weeks.

3. In this case a fan installation did not deliver the required capacity. The fans were about 2 ft. in diameter, of the single-width, single-inlet type, driven by variable speed d.c. motors. One of the fans was set up on a test plate under test code conditions, and a standard 20-station traverse showed that the volume of air was 9,730 c.f.m. at 8.4 in static pressure at the plane of the traverse and at about the specified speed. (Specified working conditions were 10,000 c.f.m. against 9 in. static pressure and operating at 2,050 r.p.m.)

The air density in the test was 0.0715 lb. per cu.ft. Making the usual corrections for speed, air density and duct friction prescribed in the test code, we obtained a test point of 9,730 c.f.m. at 8.91 in. water gage at the fan discharge and specified speed. This test point was within 2 percent of the performance curve. Therefore the fan performance checked the factory basic test results for this design of fan.

### *Installation Observations*

The next step was to determine the difference between the test code set up and the actual installed job. The following observations may be noted:

(a) The net clearance between the inlet end of the intake duct and the building wall (Fig. 4) was much too small; the space should be about 0.7 of the duct diameter.

(b) As originally installed, the room containing the fans lacked sufficient opening through which the fans could receive air. This condition was eliminated in the case of the unit tested by furnishing additional louvered openings.

(c) In order to segregate the pressure drops, an impact tube was used at different stations along the direction of flow. The loss through the room wall louvers was practically negligible. At the time of the test there was 1.5 in. before adding the louvers, which made the fan inlet suction 1.6 in. water gage. The fan then boosted the pressure from this 1.6-in. suction to 7.68 in. at the fan discharge. There was, then, a drop of 1.78 in. from the fan discharge through the air heater to a point in the system about at the furnace center door, where a Pitot tube is permanently installed; following this, there was a pressure drop of 2.3 in. to the point where small slide dampers are installed in the 8-in. burner feed pipes.

(d) With the system existing during the above readings, the equivalent of 6,700 c.f.m. required the fan to overcome a total pressure of 9.28 in. and if the system remained unaltered, but with the fan speeded up enough to handle the desired 10,000 c.f.m., the fan would then be working against 20.625 in. total pressure and about 20 in. static pressure. This 20 in. is obviously much higher than the 9 in. anticipated when the fan was selected.

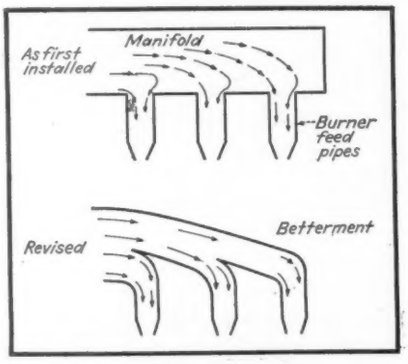



FIG. 5—Improvement of manifold system by streamlining

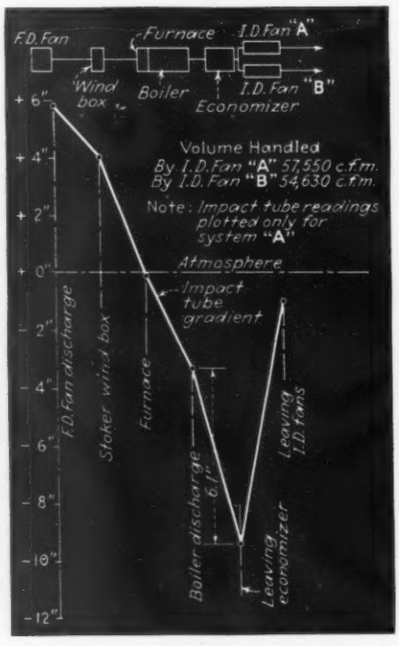



FIG. 6—Test results in analysis of air and gas flow where economizer caused excessive pressure drop

On this fan as installed provision was made for both speed control and inlet damper control. The speed control is by far the most efficient method of volume reduction since the horsepower decreases as the cube of the speed reduction. The solution of the problem suggested and carried out was to clear the fan inlet of the inlet slide damper and its supporting collar. This eliminates much inlet resistance as well as substantially increasing the axial clearance between the fan casing and the brick wall. Should a damper be required later in this system it can be installed just downstream from the permanent Pitot tube location.

### *Streamlined Manifold System*

The 5.9-in. pressure at the permanent Pitot tube would increase to 13.1 in. when the fan is handling 10,000 c.f.m. This will drop substantially when the manifold and burner feed pipes (Fig. 5) are revised to streamline flow of air.

4. In another public utility plant, where the steam output was below that expected, there were two induced-draft fans per boiler, each designed to deliver 64,800 c.f.m. at 9 in. static pressure and 375 deg. F., speed 1,160 r.p.m. These fans after installation were considered unsatisfactory, judging by the steam output realized. However, the user decided to exhaust all other possibilities before registering any strenuous complaint, knowing from experience that what appears to be fan trouble may readily be something else on the system.

All investigations outside the fans having failed to solve the problem, it was planned to run a complete field test on the fans, adhering as closely as possible to the NAFM code. In the submission of the duct layout to the fan manufacturer for the determination of the location of the Pitot tube stations to be used on test, it appeared that at some points in the system there were chances of improving the flow in the duct work by internal streamlining. The corrective guide vanes suggested and installed are shown (Fig. 7).

These vanes were fabricated and incorporated as part of the revised system. Suggestions were made as to where impact tube readings should

be taken at various points along the system. The duct on the discharge side of the fans was fortunately very long, which afforded an opportunity to obtain exact velocity pressure traverses from which volumes were determined. The test results and a schematic layout are shown (Figs. 6 and 7). Details of the vanes used appear in Fig. 8.

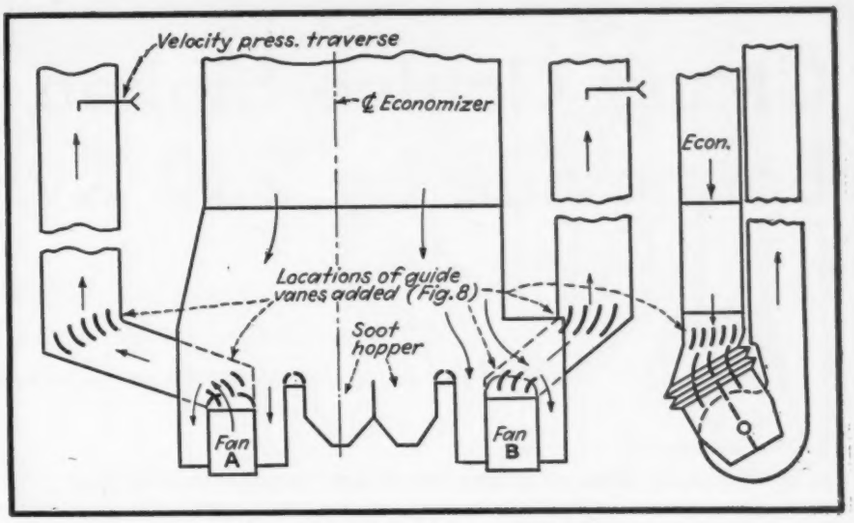



FIG. 7—Improvement of air and gas flow by use of guide sheets

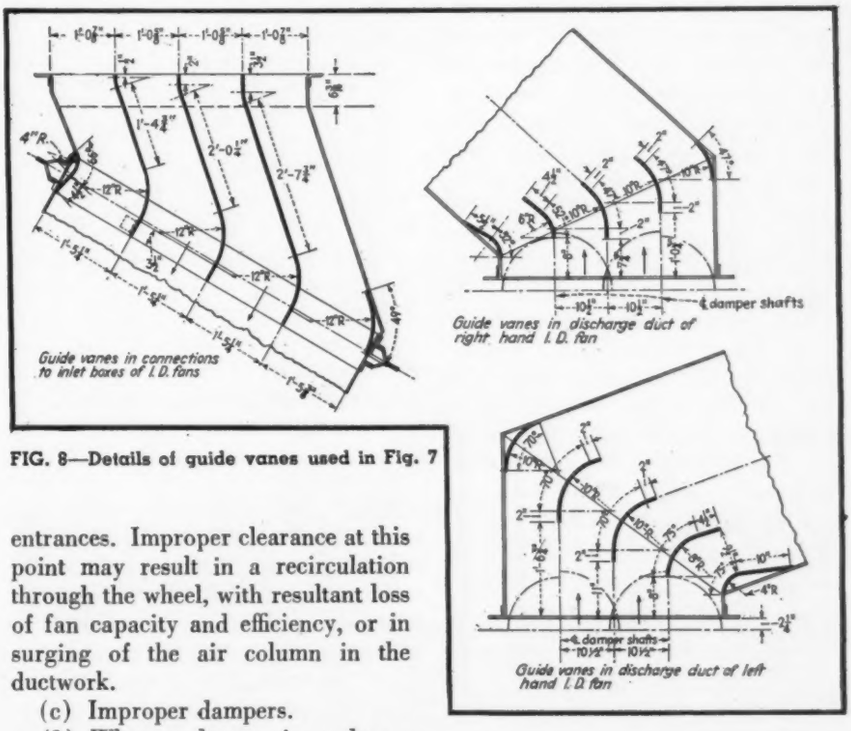

Guide vanes in connections to inlet boxes of I. D. fans
Guide vanes in discharge duct of right hand I. D. fan
℄ damper shafts
Guide vanes in discharge duct of left hand I. D. fan

FIG. 8—Details of guide vanes used in Fig. 7

### *Pressure Drops Studied*

A study of the pressure drops across the various parts of the system enabled the plant owner to determine which of these component parts had pressure drops in excess of those contemplated. The outstanding and obvious excess loss was that through the economizer. In the case of system "A" the loss was about 6.1 in. water gage in spite of the fact that only 57,550 c.f.m. of gas was flowing. This meant that had the specified volume of 64,800 c.f.m. been flowing, the loss would have been 7.7 in., or about 85 percent of the pressure which was selected to represent the entire system. At the next shutdown of this generating unit this excess loss was investigated and the trouble found to be a leaky soot blower. This leakage caused an abnormal accumulation of dust in the economizer, and when eliminated the boiler was placed back on the line, the desired steam rating obtained and no further reports of trouble were received.

A few comments on mechanical defects are given below.

In addition to the above described conditions of disadvantageous ductwork, etc., causing the performance of installed systems to depart from laboratory or test block results, many mechanical defects contribute to failure to obtain expected results. Among these are:

(a) Large fans, which must be assembled in the field, sometimes have wheels installed in such a way that the blades rotate exactly opposite from the designed manner; *i.e.*, a backwardly curved blade is used as a forwardly curved one. This applies particularly to where a plant extension includes wheels intended for clockwise and others for counterclockwise rotation. It is more apt to happen in the case of double rather than single inlet fans.

(b) Improper "sealing" between fan inlet pieces and wheel sideplate entrances. Improper clearance at this point may result in a recirculation through the wheel, with resultant loss of fan capacity and efficiency, or in surging of the air column in the ductwork.

(c) Improper dampers.

(1) Where a damper is used as a natural draft by-pass, damper leakage allows a surprising amount of recirculation from the discharge side of the induced-draft fan to the high suction region near the fan wheel inlet. (2) In the case of a row of boilers serviced by a common induced draft fan, a leaky damper at the outlet of an idle boiler in the row allows cold air to be drawn through this boiler. This air is handled by the fan without having assisted in generating steam or being otherwise useful. (3) Damper operating arm (outside a duct) not registering properly with the damper leaf positions, thus limiting the maximum capacity.

(d) Unsuspected accumulations of dust or other obstructing materials, as well as volume measuring devices with excessively high loss, limit capacity.

(e) Improper location or design station instruments giving false indications to operators, and thus misleading them in making adjustments to other combustion controlling devices.

The improvement of stations along such lines, which represent several taken at random from a long list, can readily aid the war program by increasing available plant capacities inexpensively where gaps between outputs achieved and ratings desired exist for remediable consideration.

# Grand Coulee Linked to Bonneville by 230 Kv.

*Insufficient justification for 287 kv. — Steel towers for 230 kv., wood structures for 115 kv. — Conductors ACSR or copper — Insulation and protection coordinated for high impulse performance*

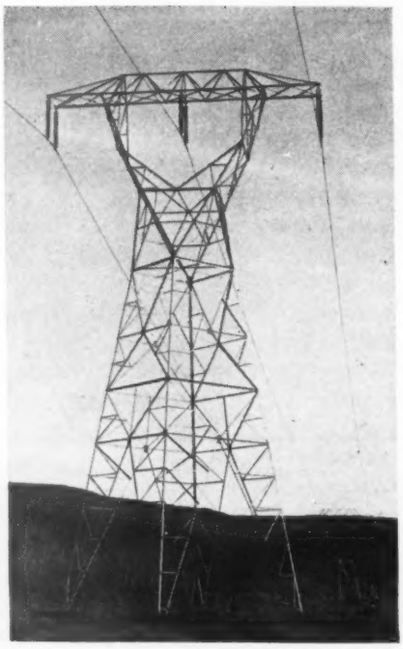
**S. E. SCHULTZ, Chief Engineer Bonneville Power Administration**

CONSTRUCTION of Grand Coulee Dam makes 1,296,000 kw. available as a by-product of its irrigation and river control functions.* The 230-kv. grid ties this capacity with the 518,000 kw. at Bonneville to serve western Oregon and Washington. Spokane is to have two 230-kv. and two 115-kv. lines running east from Grand Coulee and a third 115-kv. line from the circuit serving southeastern Washington.

In the design of the Bonneville system it was necessary to provide for the distribution of the full potentialities of the Columbia, while caring for the immediate and near future developments of the present generating plants and supplementing any existing networks. This led to the adoption of a major transmission grid or "backbone," which can be strengthened as needed, and from which lighter transmission networks radiate.

The backbone of the system is a high-voltage multi-line loop connecting all the major generating and load points either directly or by means of short feeders. This loop, for all practical purposes, is a continuous bus supplied by high-capacity generating plants and serving major substations. Lines radiating from the substations serve specific loads or load areas at voltages consistent with the power requirements and the transmission distances.

The power to be transmitted over the system backbone dictated the use of either 230 kv. or 287 kv. However, studies indicated that the use of 287 kv. would not result in a markedly higher stability limit than the use of 230 kv. for this application—(1) an increase in transmission voltage is comparable to a decrease in line reactance; (2) line reactance is but a link in the total reactance of generators, step-up transformers, lines, step-down transformers and loads, and (3) because of economic and design considerations, the rotational speeds of the generators at Bonneville and Grand Coulee are low and the reactances high, as compared with generators such as those at Boulder Dam.



**DOUBLE insulator strings on heavy tangent towers where extra vertical strength is required on the Bonneville-Coulee 230-kv. line**

Economic studies showed a considerable advantage for 230 kv. over 287 kv. transmission when the overall costs of lines and substations are included. These facts, plus the accepted practice of requiring at least two transmission circuits for reliable operation, and including the consideration that two 230-kv. circuits can transmit the output of two generators such as those at Grand Coulee, or four generators like those at Bonneville, to any point within a reasonable distance, led to the adoption of 230 kv. as the major system transmission voltage.

### *Basic Construction Program*

Construction of the second line between Grand Coulee and Bonneville started late in December, 1941, and is now in progress. Construction of the second line from Grand Coulee to Covington, and thence to Vancouver, will follow the design work, which is nearing completion. The addition of a third member to the backbone will first take place between Bonneville and Vancouver, right-of-way for which is now being cleared. Design for contemplated third and fourth Coulee-Covington circuits is also under way.

The Midway substation permits sectionalization of the Bonneville-Coulee lines and provides a 115-kv. supply for lines which radiate westward into central Washington and eastward to serve southeastern Washington and northeastern Oregon. Other sectionalizing points, besides Bonneville and Coulee, are the substations at Vancouver, Chehalis and Covington. Each of these major substations is the source of supply to the many lines radiating from it.

* See "Grand Coulee Primes Columbia River Hydro," *Electrical World*, March 21, 1942.

Two 115-kv. and two 230-kv. transmission lines will extend easterly from Grand Coulee to Spokane, Wash. The 115-kv. lines, now under construction, are of wood-pole, H-frame design. Surveys and design work are in process for the 230-kv. lines. These will be supported on double-circuit steel towers.

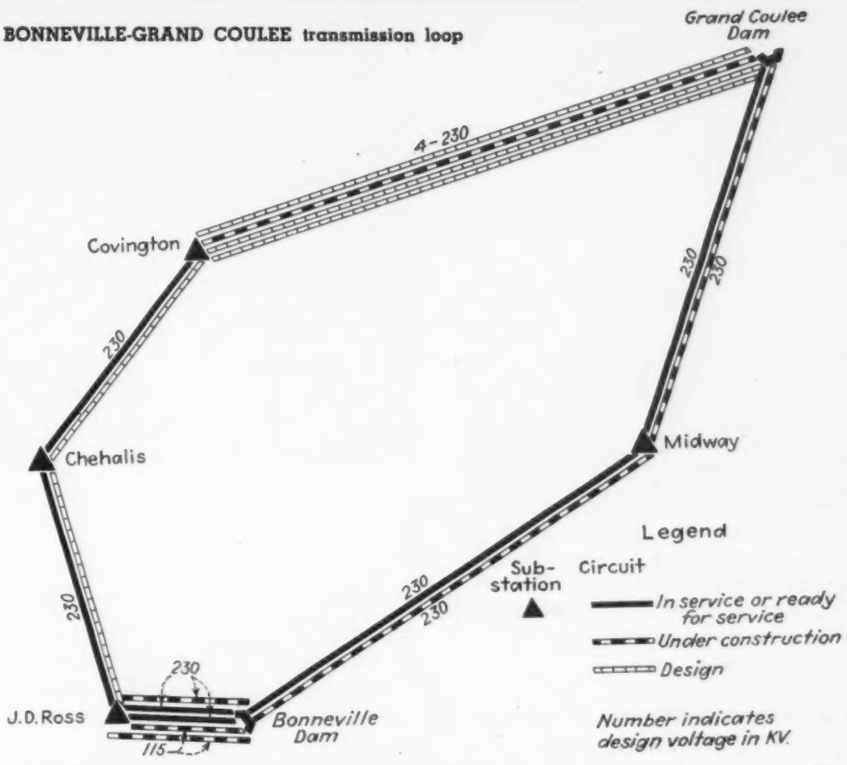
An additional line to the Spokane area will be supplied by the continuation from Colfax to Spokane of the easterly 115-kv. line from Midway substation.

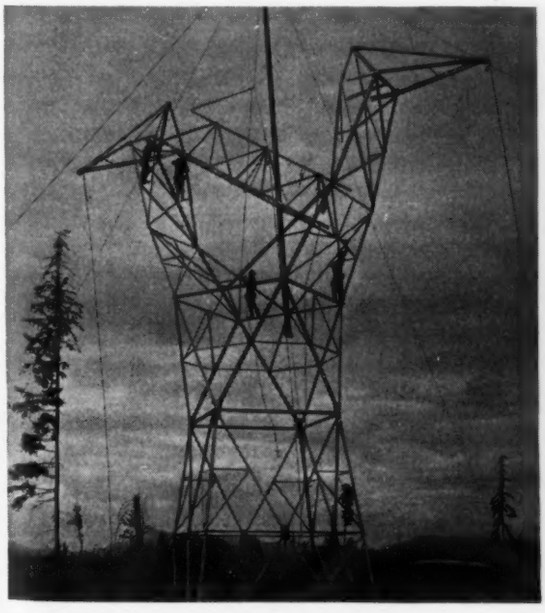
In building its transmission system the Bonneville Power Administration has made use of both steel-tower and wood-pole construction. All 230-kv. lines are considered as Class 1 lines, and accordingly are of steel-tower construction; 115-kv. lines are generally supported on wood-pole, H-frame structures; single poles are used only where necessitated by limited right-of-way. The use of steel towers for 115-kv. lines is limited to unusual loading conditions, to regions having unusual construction problems, to localities in which lines are difficult to maintain, or to costly, heavily timbered areas, or where narrow rights-of-way require double-circuit construction. Lower voltage lines are built in accordance with the terrain they traverse and the service for which they are designed.

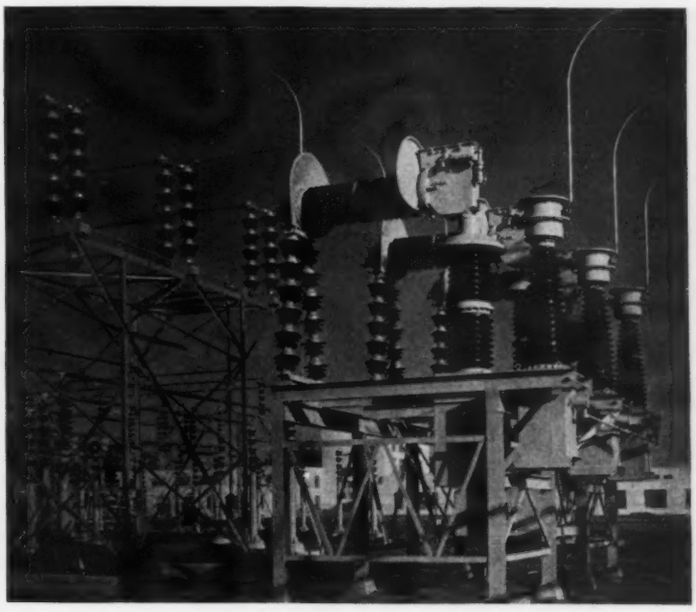
Conductors were chosen on the basis of the lowest bids meeting specification requirements. For each transmission voltage corona limits were established from which minimum conductor diameters were determined. Based on these diameters, other characteristics were chosen to meet the conditions of mechanical and electrical loading of the various lines. These characteristics were included in conductor specifications, which were advertised in the usual manner.

Award of contracts to low bidders resulted, until recently, in the use of two types of 795,000-cir.mil ACSR conductor for the 230-kv. lines. These conductors have different physical characteristics as required by mechanical loading conditions, but both have 500,000-cir.mil copper equivalence. Following recent defense restrictions on aluminum, contracts have been awarded for expanded 500,000-cir.mil copper conductor of various manufacture and with physical characteristics corresponding to

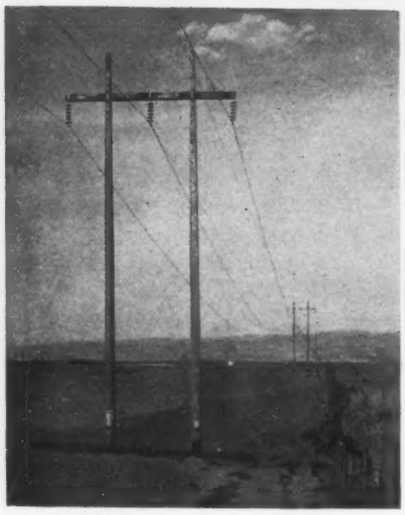
**BONNEVILLE-GRAND COULEE** transmission loop



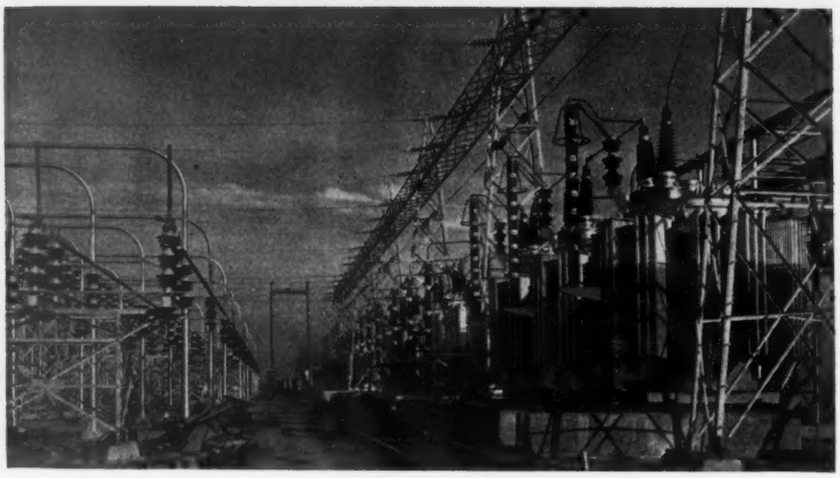





**STANDARD** light tangent tower being erected for 230-kv. line (left). One type of three-cycle breaker used for principal 230-kv. switching operations (right)



**H-FRAME** construction on the Walla Walla-Lewiston 115-kv. line with overhead ground wires used near substations; double-circuit steel towers used for 115 kv. on restricted rights-of-way



**SUBSTATION** to serve large industrial load at 115 kw.; five of the six 37,500-kva. transformer banks installed

the conditions of use. Awards for the 115-kv. lines have been principally for copper conductors. Expanded construction was required for both the 250,000- and 350,000-cir.mil copper conductors to provide the minimum diameter indicated by the corona studies. Special conductors are used at river crossings or where unusual conditions apply.

Standard 10-in., 15,000-lb. suspension insulators are used in strings of sixteen units on 230-kv. suspension towers and in triple strings of eighteen units each for dead-end towers. Strings of six units are used on 115-kv. wood-pole suspension structures, with seven units being employed for dead-end strings. For 230-kv. lines conductors have a horizontal spacing of 27 ft.; the conductors for 115-kv. H-frame lines are spaced 12 ft. apart.

The Bonneville Power Administration has been fortunate in that the frequency of lightning storms is relatively low in the states of Oregon and Washington. The majority of the storms likely to prove troublesome occur chiefly in the Cascade Mountain region in Oregon and Washington, the Blue Mountain region in Oregon and in the vicinity of the Wenatchee Mountains in Washington. As the Bonneville transmission lines have been located to avoid these areas, except where necessary to cross them, or unless other routes had greater disadvantages, only a small percentage of the system traverses the areas of higher storm frequency. However, it has been deemed advisable to take the following steps to protect equipment from the effects of lightning storms as may occur.

1. Overhead ground wires are installed for each transmission line entering substations and switching stations for such a distance as is believed sufficient to prevent the entrance of extremely steep-fronted surges. Surge-limiting equipment is installed at the station.

2. Overhead ground wires are installed in those sections of lines traversing regions known to have a relatively high lightning storm frequency. Provision is made for the installation of overhead ground wires through any other areas which experience later indicates desirable.

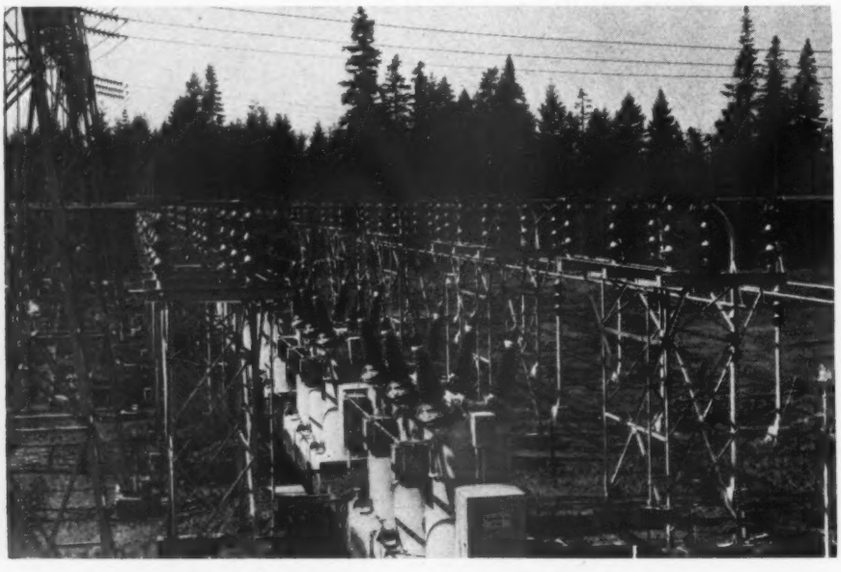
3. The footing resistances of all towers is measured and recorded. This information, used in connection with later experience, indicates where footing resistances should be lowered or where counterpoise should be installed.

4. Substation insulation is coordinated as follows:

(a) Lightning arresters are located adjacent to transformers. Eighty percent lightning arresters are used on solidly grounded neutral circuits.

(b) Transformer bushings are gapped to a level slightly below that of remaining station insulation by rod gaps placed far enough away to prevent bushing damage. All apparatus bushings and insulators on the 230-kv. system are rated at 196 kv.

(c) To prevent flashover of apparatus insulators located at some distance from lightning arresters it is planned to install rod gaps at points where lines enter major substations.



**SIMILAR LAYOUTS** at other major substations to this 115-kv. switchrack under construction at Chehalis substation

# Control and Regulation of Utility-Industrial Ties

*Different conditions of operation of industrial plant generation facilities make different demands on central station service and thus require various functions and devices of control*

*L. F. STONE, General Electric Company, Newark, N. J.*

WITH war conditions requiring even higher industrial productions, and this in turn demanding increasing amounts of electricity, the loads on generating facilities in industrial plants approach capacity limits. Addition to generating facilities may be uneconomic, or even impossible, and certainly will entail delay, so the industrial plant operator turns to the central station system for the additional electric power he needs.

The economic justification for generation of electricity in many industrial plants is recognized by most engineers where steam is used in manufacturing processes or waste heat is available from processes. In either case electric-generation is a by-product operation. On the basis that demands for process steam, or usable quantities of waste heat, allow generation of proportionate amounts of electricity, a plan is worked out within the rate structure of the power company to synchronize the industrial generating facilities with the central station system. Under such a plan the central station system may act as standby and supply power for peak loads only, or the local plant may take the peaks and the power company the base load. Whatever the plan may be, there are a number of operating control functions, any or all of which may be necessary or desirable in a particular case. It is the purpose of this article to explain these functions in terms of the equipment available for discharging them.

Most rate structures provide for (a) a minimum base charge, (b) a maximum demand charge and (c) an energy charge. On this basis it is most advantageous for the customer to use the greatest number of kilowatt-hours of energy with lowest practical maximum demand. This requires automatic regulation which can be preset for the desired maximum demand.

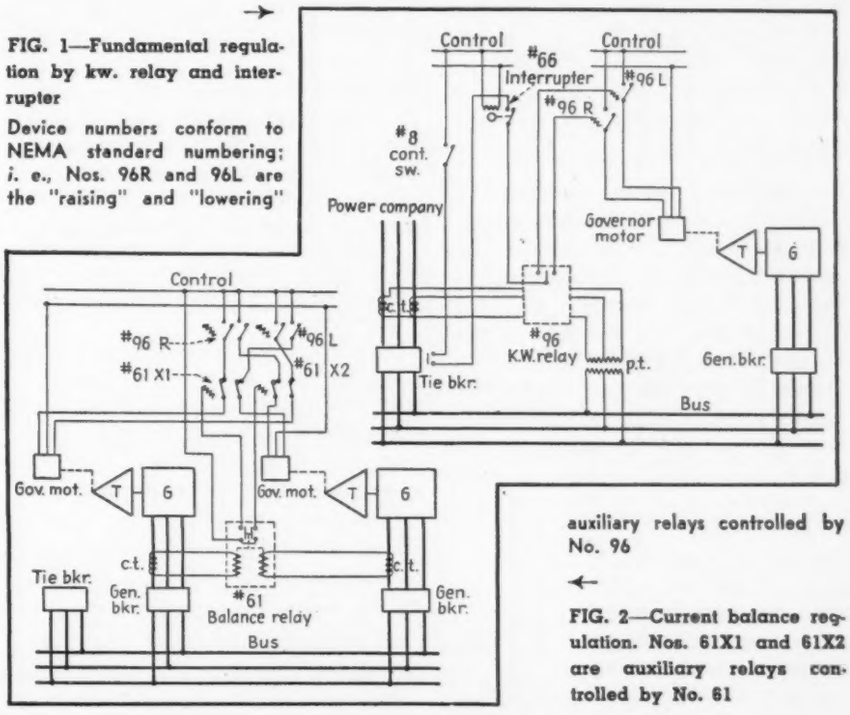



**FIG. 1—Fundamental regulation by kw. relay and interrupter**

**Device numbers conform to NEMA standard numbering; i. e., Nos. 96R and 96L are the "raising" and "lowering" auxiliary relays controlled by No. 96**

**FIG. 2—Current balance regulation. Nos. 61X1 and 61X2 are auxiliary relays controlled by No. 61**

Since industrial load characteristics vary with the industry, there is no one regulating scheme which is universally applicable. Instant response to high peak loads is needed in a mining application, while electrolytic loads may be almost constant. However, for the general industrial application, the scheme here outlined has proved successful.

**A. Kilowatt relay controlling turbine governor setting.**

In the power company's feeder is connected a polyphase kilowatt relay which may be set to operate at any point from zero to the full kilowatt rating of the service. Through auxiliary relays, this performs the function normally taken care of by the governor control switch of the engine or turbine-driven generator. Consequently, as the load drawn over the power company's feeder exceeds the setting of this relay, an impulse is sent to the governor motors, tending to operate the generators at a higher speed. This makes them draw a greater proportion of load and reduces the power drawn from the power company. Similarly, when the demand for purchased power goes below the kilowatt relay setting, the

governor motors try to run the generators a little slower, causing them to take less load and drawing more from the power company.

**B. Interrupter for anti-hunt control.**

There is an appreciable time interval between the operation of the kilowatt relay and the response of the generators, depending on the rating of the generator and the type and speed of governor motor. To compensate for this, an interrupter is used which allows the kilowatt relay impulse to flow for only a small proportion of the time, say three seconds out of fifteen seconds. In this timer the proportion of time "on" to the total time cycle can be varied over a wide range, and this, together with a possible adjustment of an unusually slow or fast governor motor, gives a control that regulates quite accurately and without tendency to hunt. Fig. 1 shows the fundamental circuit for this regulating scheme.

**C. Load balance between machines.**

The foregoing described devices are all that are required basically for the regulation of a single unit station. For stations with several generators there is a tendency for the various machines to regulate away from the desired proportioning of load. This can be checked by careful supervision from the operator in the same way that he took care of it when the plant was running as an individual station. However, with more frequent load regulation, this duty becomes more onerous and automatic means have been made available for taking care of it. Such means consist of a load balance relay between two machines (see Fig. 2), or between each machine and a totalizing element. The device operates to interrupt the load-increasing impulse on the more heavily loaded machine or to interrupt the load-decreasing impulse on the lighter loaded machine as these impulses come from the master kilowatt relay, so as to bring the regulated load on the machines back to the desired relation. A feature of this balanced relay, which is particularly important where the various prime movers are supplying different process steam systems, is a means of biasing this balance relay so that the ratio of load on the two machines can be held at any ratio from 1:1 up to better than 1.5:1.

**D. Overload protection on machines.**

If the kilowatt relay were trying to hold a very low demand on the power company and the total plant demand increased unexpectedly, the plant generators would tend to regulate up to a point where they might be overloaded. To prevent this an overload relay in each machine may be provided to prevent the load-regulating equipment from further raising the load on a generator when it has reached its safe maximum load.

**E. Cutoff of regulation on heavy peaks.**

In a single unit station the failure of the plant generator might cause a very sudden increase of power company's load. If the regulator were left in service it would increase the governor setting continually without effect on the power company tie and overspeed the turbine. Similarly, if the power company breaker should open on fault, the regulator, in an effort to make this open line take load up to the relay setting, would continually reduce the governor setting and, therefore, the frequency of the generator. Under both these conditions the load regulating equipment can be cut out of service automatically.

**F. Removing dispensable load to reduce demand.**

In cases where the total power company contract demand is not enough to run the whole plant or where the demand rate increases after a certain maximum demand has been reached, it may be worth while to group part of the load so it can be tripped off in case the present maximum demand is reached. This can be done by an additional kilowatt or current relay on the power company line.

**G. Separate day and night demand regulation.**

In some load-control applications the power company has separate night and day rates so that it might be economical to use more power during the night hours. Under these conditions, two regulating kilowatt relays could be used, one set for the desired night demand and one for the desired day demand, with the control transferred from one to the other by a time switch operating synchronously with the transfer switch on the power company's metering.

As stated, all the foregoing functions may not be necessary in any one installation, but they are listed to show the various features that can be incorporated in such a control to meet the requirements of the particular job. Of course, any of the limit functions can be provided with contacts to operate an alarm when the condition arises for which the particular device is set and in this way call the attention of the operator to the abnormal condition. In addition to this, as a backup or telltale, it is possible to arrange an alarm which will ring if the kilowatt relay in the power line holds one or the other of its contact positions for too long a time, indicating that something in the control is not performing its function. Such a device may prevent the establishment of a maximum demand in case of trouble with any device in the circuit, as the alarm would operate, in many cases, before an operator, accustomed to the automatic features of the equipment would note that anything was wrong. Generally speaking, the availability and dependability of this sort of control, as developed, will be very high, and it is general practice in all such schemes to use some sort of telltale alarm rather than depend wholly on an operator or attendant.

### *Power-Factor Regulation*

The functions discussed above are very successful in regulating the division of kilowatt load between the power company and the private plant. But there is still the problem of circulating or reactive current. In some cases this may be taken care of by the operator controlling the generator fields, but it is difficult to hold the distribution of the reactive current within close limits in this way. The changing load and different saturation characteristics on the generators, together with voltage variations on the power company feeder that depend mostly on conditions outside the plant, would keep an operator very busy.

If any machine is carrying more than its share of the reactive load, it will become fully loaded from the heating standpoint even though its prime mover may be able to deliver additional kilowatts. This is probably the most important reason for keeping a good reactive balance. There are also the considerations of power-factor clauses in the power company contract and the desirability of using one machine which has a low process steam demand to carry a large proportion of the reactive in the plant, leaving the other machines free to develop more kilowatts and more pounds of steam.

All of this points to the desirabil-

ity of a regulating system for holding the desired amount of reactive current on each machine and on the power company tie, with provision for adjustment of this setting and capacity for regulating the voltage of the private plant when the power company line is open. Such a condition can be met very successfully with the present-day standard individual machine regulator. This regulator is ordinarily provided with a current winding as well as a voltage winding and this current winding is excited from a phase in quadrature with the unity power-factor current of the voltage phase. In this way, with the regulator set to hold a certain voltage at no load, unity power-factor current in the current coil of the regulator is at 90 deg. to the voltage and has practically no effect on the regulation. If, however, the generator is operating at a leading or a lagging power factor, a component of this current acts to "buck" or "boost" the effect of the voltage on the regulator coil and the regulator can be made to raise or lower the generator field strength, in which case the reactive is shifted to some other source. With two machines working together in a private plant, each with such a regulator, the reactive kva. of the load tends to divide between the machines in proportion to their capacities and regulator settings.

### *Power Company Tie*

A similar scheme can be used when a machine is tied to the power company line. In this case the current transformer for the generator regulator is in the power company line connected in a similar quadrature relation so as to raise or lower the voltage of the generator in response to lagging or leading reactive current in the power company line (See Fig. 3).

Where two or more generators are used each generator must have, for its own protection, the biasing current transformer in its own line operating on its own regulator. Then the current in the power company line can be superimposed, through the necessary auxiliary transformers, to affect the field excitation of all generators.

This type of regulator is primarily a regulator of voltage, and in its fundamental function it will continue to regulate until the voltage responds to such regulation and approaches its ideal setting. If the plant generator were large enough, or the power company tie had high enough reactance, the regulator could hold plant voltage by control of leading and lagging current in the tie, as is done with a synchronous condenser. But when tied to a large source through a relatively heavy line, as is generally the case, it cannot be expected to maintain the ideal voltage. Then its reactive current compensation becomes the important function. Consequently, the voltage on the plant bus will rise and fall with the voltage on the power line, the regulator functioning only to keep the reactive kva. in proper relation.

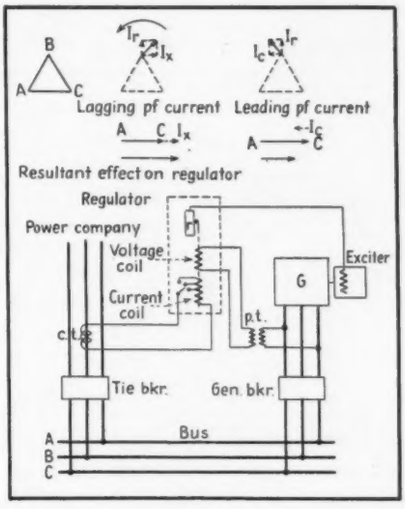



**FIG. 3—Use of voltage regulator for reactive balance**

The effect of this current compensation can be varied. The modern individual machine regulator provides an adjusting dial on a compensating impedance, which introduces a drop in series with the voltage coil. The older station type regulator controlling several generators has taps in the current coil, as shown in Fig. 3.

It is possible, also, by proper adjustment of the current winding, to make one machine more responsive to reactive current regulation than another, thus allowing it to carry a larger or smaller amount of the total plant reactive kva.

There is an ideal condition of division of load in which the private plant will generate only sufficient energy to develop either the required amount of process steam through non-condensing, back-pressure-regulated turbine generators or to utilize just the waste heat available, and will purchase from the power company all excess required. This would not result in such a uniform demand and, under present demand rates, the cost of a given number of kilowatt-hours might be a little higher. This, however, would be balanced off by the greater efficiency of the private generating plant and the lower first cost of the power generating equipment. Some new plants are now being designed and installed on this basis where analysis of the over-all plant operation is possible during the design stage.

With this scheme load-regulating equipment on the power company tie is not required. The most that would be desirable would be some sort of overload alarm or limit to prevent establishing a maximum demand value which would be wholly uneconomic. This could best be taken care of by the use of a watt-hour meter and adjustable demand limit relay. This relay could be used to cut off a block of dispensable load such as maintenance shop or air compressors in case the demand on the power company should rise to the maximum allowable value. However, under such circumstances the power factor and reactive current control becomes very important, particularly if the power contract provides a bonus for good power factor.

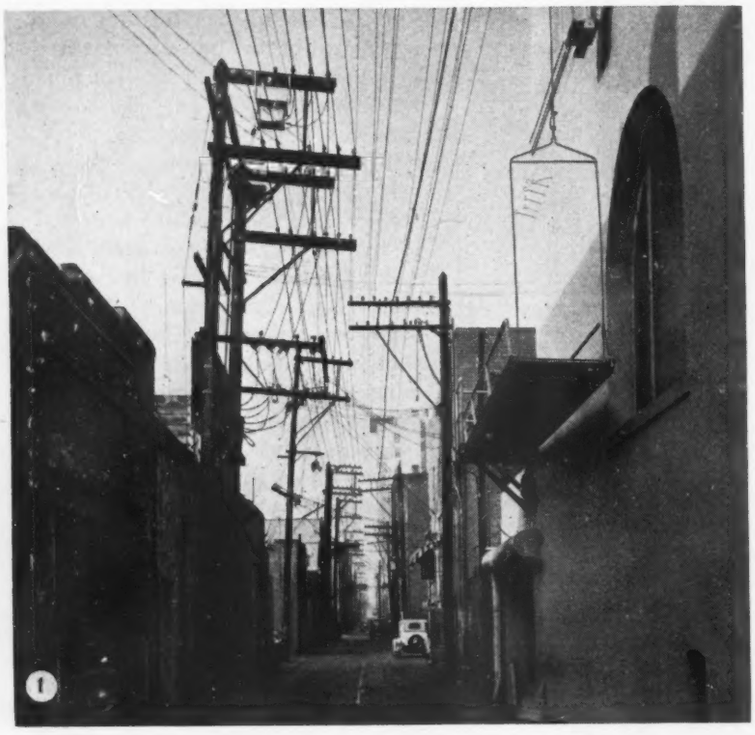
### *An Installation*

Such an installation has recently been put in, consisting of two turbo-generators with individual regulators, cross-current compensated between generators by the reactive current in the power company tie. This results in the maintenance of a very desirable power factor which could only be maintained under manual control by very careful attention from the operator.

Up to the present power company rates usually have not allowed any credit for power pumped back into the utility system from the private plant. As the demand for power in industry increases rapidly, the power company will approach its maximum capacity. Some private plants will have surplus energy because of their process steam requirements. Then interchange contracts may be desirable to utilize all available generating capacity in a given area.

# Flexibility Features Underground Use of Non-Metallic Cables

*H. H. MINOR and E. S. DREISCHMEYER, Division Distribution Engineer and Assistant Distribution Engineer, San Joaquin Power Division, Pacific Gas & Electric Company, Fresno*



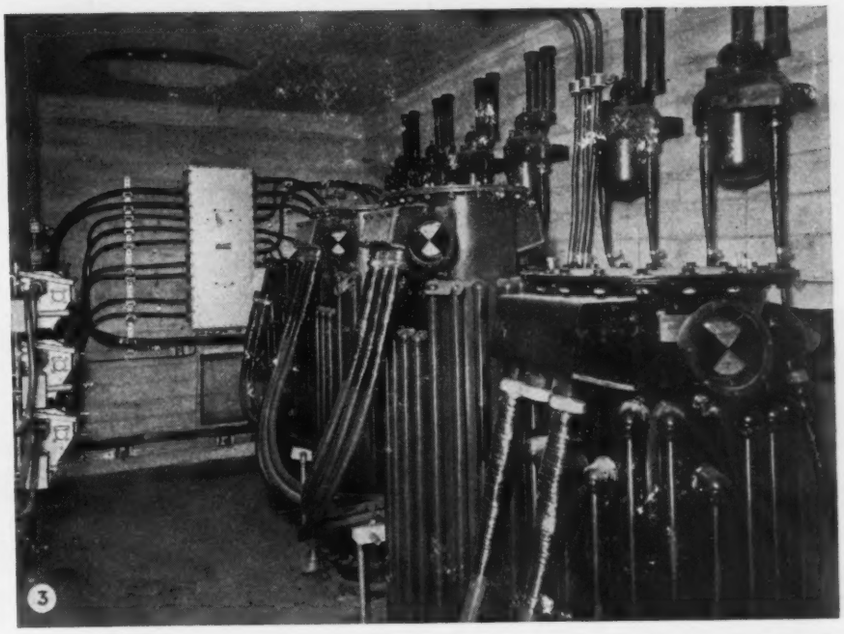
PROGRESSIVELY EXPANDED Fresno downtown installation, where peak loads and high ambient temperatures occur during maximum temperature periods, uses cables with rubber compound insulation and non-metallic coverings; system includes underground capacitors; designed for initial 2,400-volt operation, it can be cut over to 4,160 volts.

To date the Fresno system has been practically free from trouble. High temperatures during peak loads have necessitated some mechanical transformer vault ventilation. The use of non-metallic rubber compound cables has been very satisfactory, as has been the application of capacitors. Best testimonial for the installation is that it is to be extended in 1942.

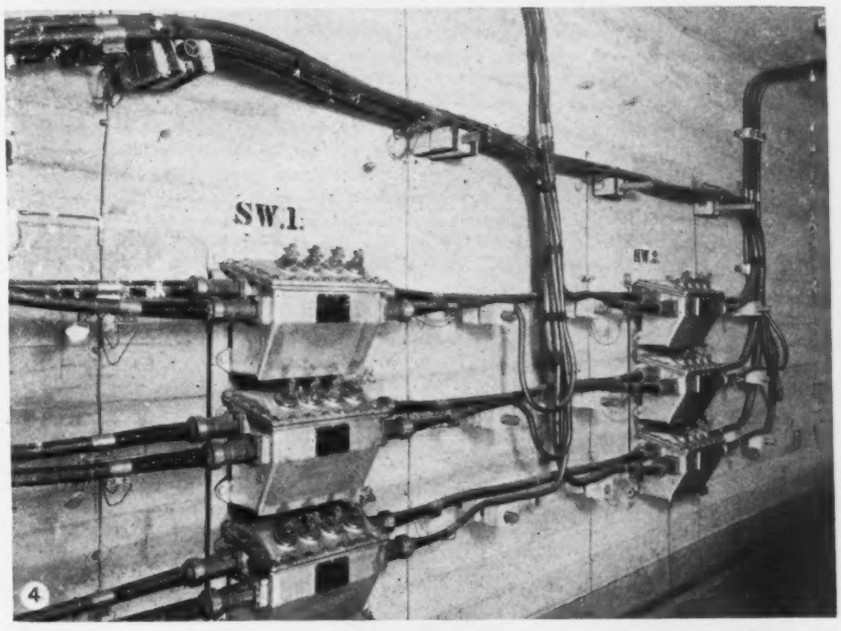
**1** When load grows progressively and an alley distribution system expands to meet it, this is what ultimately prevails—an unsightly, badly overloaded, high-maintenance-cost system. This "before" picture was typical of the Fresno business district, where a 2,400-volt primary network grew up with radial alley secondaries. Part of these were six-wire supplied from separate power and lighting transformer banks, and part were four-wire, 120-240-volt delta-connected secondaries served from combination banks. Because of heavy air-conditioning loads, 54 percent of the total load was three-phase power. So a progressive under ground program was initiated in 1938, with a fifteen-block area selected for change-over.

**2** After the lines go underground, here is a view down the same alley with only some communication facilities in evidence. The original three-phase, four-wire, 120-240-volt system was followed in the underground change-over because of the large power load and a considerable 240-volt commercial cooking and heating load. However, consideration was given to three-phase, four-wire, 120-208-volt star secondary system, which was installed in a later change-over. Obstructions in the 20-ft. alleys included water and gas mains, sewers, telephone duct lines and manholes, telegraph lines, fire alarm systems and even oil tanks. Duct lines were run in 7½-ft. deep trenches, 4 ft. from the property lines. Conduit risers to new service boxes are shown on several buildings.

**3** First unit of the alley underground required twelve 23-ft. long by 9-ft. wide by 10-ft. high transformer vaults, designed for an ultimate installation of five 200-kva. transformers. This vault contains two 150-kva. and two 200-kva. transformers in a delta-delta bank. Three 4-in. fibre ducts were run from vault to vault for primary cables with a bank of six 4-in. ducts above and separated from them for secondaries, which combine into one duct bank as they approach the vault. Three service manholes per block were built in the duct line for the secondaries, the primaries passing underneath them. Delta connections for the secondaries in the vaults are made in an eight-way, 2,000-amp. stainless steel junction box shown in the background. Each way will accommodate three single-conductor non-leaded cables. Secondary mains are taken from these junction boxes and are fused with copper link fuses inside the box.

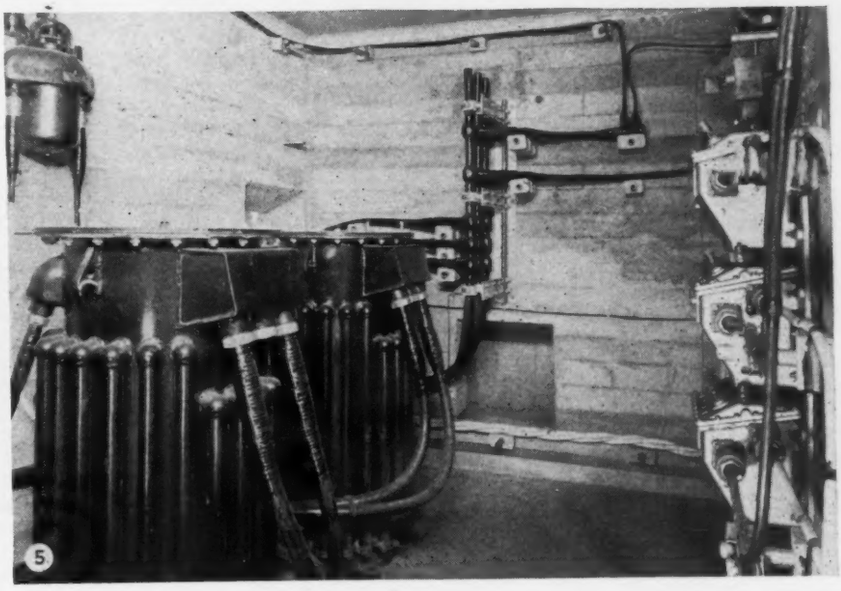



**4** Primary mains in the vaults terminate in four-way oil-break disconnects such as those pictured. Thus any vault can be fed from either or both of two sources. Transformer taps are either No. 2 or No. 1/0 non-leaded cables with asbestos braid. Conventional type oil fuse cutouts are used. All terminals on the oil-break disconnects, cutouts and transformers are of special design to accommodate single-conductor, non-leaded cable. Some of the larger buildings in the area have independent transformer vaults. Primary services to these are taken from the oil-break disconnects in the nearest street vault, permitting a two-source feed to any of these buildings.



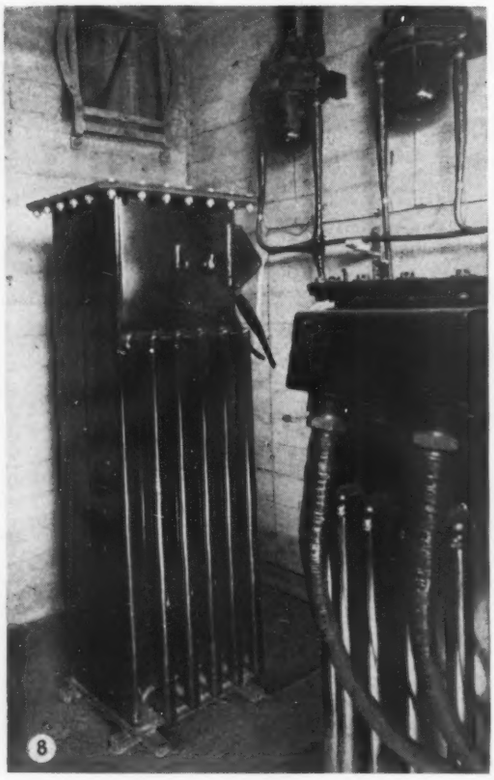

**5** Following completion of the first installation, a second five-block extension was undertaken with distribution changed to three-phase, four-wire, 120-208 volts star. Some difficulty resulted, requiring the use of auto-transformers in a number of cases to raise voltage to 240. Six transformer vaults, 16 x 9 x 9 ft., were built. In this view two of three 100-kva. transformers in a 2,400-volt delta to 120-208-volt star bank are shown. Transformer leads form a bus at the end of the vault to which the secondary mains are connected by means of limiter taps. Primary oil-break disconnects are shown at the right. In the original installation primaries were 500,000-cir.mil single-conductor non-leaded cable twisted together; in this second, 250,000-cir.mil. The first installation had either 250,000 or 500,000-cir.mil, rubber-insulated secondaries with weatherproof cotton braid installed in various combinations to accommodate the load. Neutrals were either 250,000 or 500,000-cir.mil bare conductors. In the extension 250,000-cir.mil secondaries and No. 4/0 bare copper neutrals were used.

[*See page 60*]

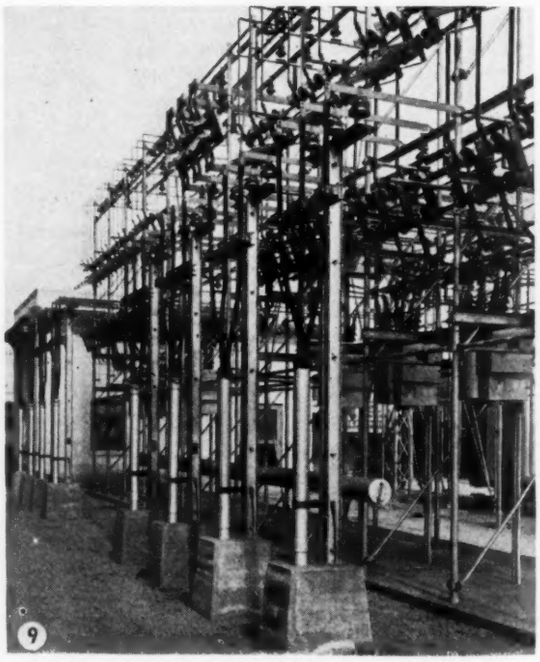


6 Underground transformer vaults and service manholes replaced this typical alley overhead construction as part of a planned distribution change-over program. Three service manholes per block, 150 ft. apart, were constructed. In service manholes adjacent to transformer vaults secondary mains run through multitaps to provide service connections. In manholes in the center of the blocks secondaries terminate in separate multitaps. Thus adjacent transformer banks are not paralleled on secondaries and transformers carrying the bulk of the single-phase load are connected on different phases of the primary. In an emergency load from one transformer bank may be picked up by an adjacent bank by first dropping the load on the bank in trouble and then connecting between multitaps in the center manhole.

7 Service runs to the buildings from the manholes were either 3-in. or 4-in. heavy-wall fibre duct laid without a concrete envelope. In most cases the building services were picked up at their existing locations. Three or 4-in. conduit risers terminated in a galvanized weatherproof service box. Where buildings were set back some distance from the alleys, handholes were installed at the property lines. Service conductors are single-conductor, rubber-insulated cables with weatherproof cotton braid, ranging in size from No. 6 to 500,000-cir.mil. Standard practice is to run a 4-wire service from the manhole to the service box and separate the single-phase and 3-phase building service there. Connections are made with insulated type connectors. There are no fuses on the service runs.



8 Because of the high percentage of air conditioning motor loads in the large downtown buildings, the power factor was low. This brought on high current values in some primaries and excessive voltage drop during peak loads. As these peaks occurred during summer days when ambient temperatures were high, it was necessary to correct the condition by installing capacitors. Twelve 135-kva. capacitor units were purchased for underground installation, with one located in each of the twelve vaults serving the heavily loaded area. Each of these units consists of nine 15-kva. indoor type capacitors which are inclosed in an oil-filled tank. Connections are arranged for 2,400 volts delta or 4,160 volts Y, since it is contemplated that the whole underground system may be cut over to the higher voltage at a later date.



9 This new 10,000-kva. substation was erected as near as possible to the heavy load area to complete the primary network. It consisted of six feeders served from two sources. This shows the 2,400-volt 500,000-cir.mill risers from the underground system. In the extension of previously installed cables to this new station three twisted, single-conductor, 500,000-cir.mil non-leaded cables were used. They are insulated for 5,000 volts with an oil base compound rubber insulation. Both asbestos-braided and neoprene-jacketed cables were installed.

# Out-of-Step Indicator Visualizes Asynchronism

***Cathode-ray tubes adapted for synchronism indication on 60,000-kva. frequency changer — Aids in preventing serious system disturbances***

***T. M. BLAKESLEE, Los Angeles Bureau of Power and Light***

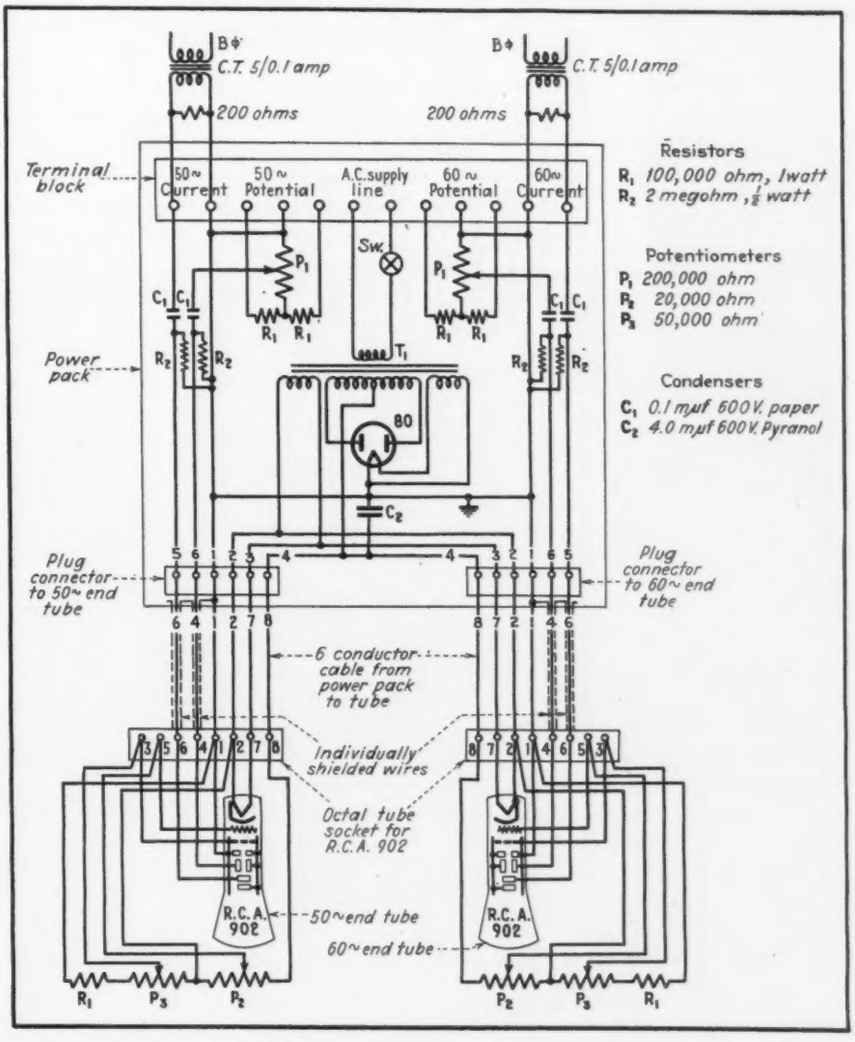
OPERATING experiences with the 60,000-kva. frequency changer used by the Los Angeles Bureau of Power and Light in its system connection with the Southern California Edison Company demonstrated the desirability of out-of-step indication on the two synchronous machines of this unit. Out-of-step indicators were devised and installed on the control board for the frequency changer, where they have given valuable service.

For the frequency changer the indicator consists of two 2-in. cathode-ray tubes, one for the 60-cycle unit and one for the 50-cycle unit of the frequency changer. These tubes are mounted on the control boards for the respective units. They are recessed to provide light shielding for the fluorescent screen, thereby making the image more visible to the operator.

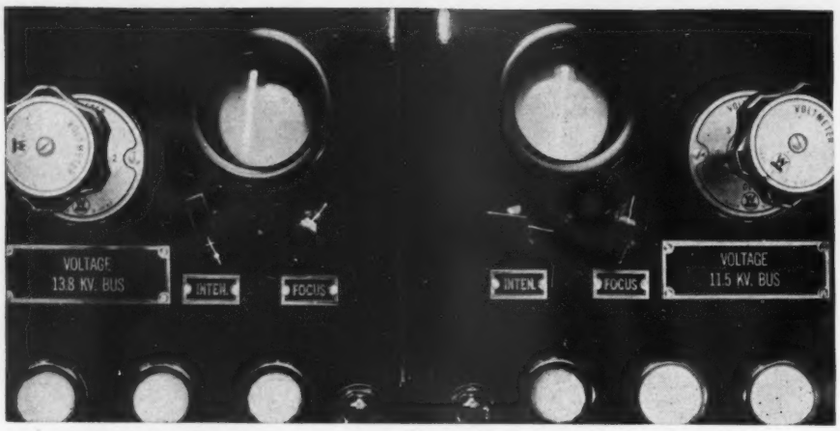
Power for the indicator is obtained from a small d.c. to a.c. dynamotor operating from the 250-volt station control battery. A supply of this sort is essential as the regular a.c. source is obviously not satisfactory during out-of-step conditions.

### *Beam Deflection*

Deflection of the electron beam in the horizontal axis is made proportional to B-phase machine current. This beam deflection is obtained from the drop across a 200-ohm resistor in the secondary circuit of a 5/0.1-amp. current transformer in the regular B-phase 5-amp. meter circuit. Beam deflection in the vertical axis is made proportional to B-phase-to-neutral potential. This is obtained from open-delta connected potential transformers on the machine terminals through the medium of wye-connected resistor elements. It is not essential to use the wye voltage corresponding to the phase current to obtain out-of-step indication, but the use of the corresponding phase values of current




**WIRING for out-of-step indicator. The power pack uses an 80-rectifier tube with resistance potential dividers to obtain the necessary d.c. voltages for the operation of the tubes. Controls for intensity and focus of electron beam are conveniently located on meter board just below tubes**




**OUT-OF-STEP INDICATOR** is mounted on control board of frequency changer

(a) At no load the figure is a straight vertical line. At zero power factor load it is an ellipse, with length of minor horizontal axis dependent upon magnitude of load current. Under unity power factor the figure remains a straight line, but takes an inclined position from the vertical, with inclination proportional to load. At intermediate power factor the figure is an inclined ellipse. Direction of inclination of the ellipse or straight line indicates direction of power flow.

(b) For power surges the figure on the screen merely rocks back and forth, taking inclination first in one direction and then in the other as the power flows in and out of the machine.

The actual time represented by the slip cycle series is 0.78 second and the time represented by the power surge series is 0.82 second.

**PROGRESSION** of out-of-step indicator figure (a) during a slip cycle and (b) progression during a power surge

and voltage lends more meaning to the figure which appears on the screen under normal stable conditions.

Full screen amplitude in the horizontal axis is made to represent about three times full load current, while full amplitude in the vertical direction represents normal machine terminal voltage. The current deflection amplitude or calibration is dictated by machine and system reactances and is designed to maintain an on-scale figure during out-of-step conditions.

When a unit of the frequency changer slips a cycle the figure on the cathode-ray tube rotates, turning 180 deg. for each cycle of slippage. If the machine is running in an out-of-step condition the figure appears to rotate continually in one direction or the other, depending upon the relative speeds of the two systems interconnected by the frequency-changer unit.

One month after out-of-step indicators were installed on the 60,000-kva. frequency changer a system disturbance occurred which threw this unit out of synchronism. Through the medium of the indicator the operator recognized this situation and tripped the machine in ten seconds. Because of this rapid action valuable time was saved in restoring the station to normal conditions.

The life of the cathode-ray tube is largely dependent on the life of the fluorescent screen. It was felt, however, that a continuous image on the out-of-step indicator would be more desirable than a latent image to be brought to visibility through manual operation of the intensity control when a system disturbance occurred. Continuous registration of the image on the screen gives the operator a greater familiarity with the indicator and permits more rapid action, since the image may be clearly seen from the operator's desk, which is some 10 ft. from the meterboard. Tube cost is not excessive and the indicators are therefore used with images visible at all times that the frequency changer is in operation. The average life of the 2-in. cathode-ray tube, based upon operating experience with six tubes is 2,160 hours. Minimum life for the group was 1,500 hours and the maximum 3,000 hours. Laboratory tests on the used tubes show that the fluorescent screen may still produce images if higher than rated electron beam voltage is used. But so far it has not been demonstrated that this enhancement of the image is worth while to extend the useful life of the tube.

## How Power Salesmen Help Conversion

Instancing the way in which power salesmen of many electric utilities are aiding conversion of industrial facilities to war production is this account of one case in the experience of the Duquesne Light Company; this case is not exceptional; it is typical not only of this company, but of many others:

**"A power customer producing copper bonding pins and ground connectors was normally operating about five days a week and eight hours per day. Due to the difficulty of obtaining copper, their operations were being slowed and the plant was threatened with a complete shutdown. In talking with the owner, our power salesman learned of his difficulty and suggested that he visit the local WPB office to secure orders, if possible, for defense materials. The owner was reluctant to do this but the power salesman persuaded him to do so and accompanied him to the WPB office. The owner submitted bids on several occasions but received no orders. When the Defense Train was in Pittsburgh the power salesman arranged to take the owner to the train to see the many items displayed there. It took some persuasion because the owner had been discouraged somewhat due to the fact that he had received no orders after his previous attempt. When visiting the train, the owner saw a number of items which he could produce. He submitted bids on several items but again did not get any orders.**

**"Later the power salesman called the owner's attention to some items appearing on the WPB's list of materials wanted which he could manufacture and provided him with information on the procedure to be followed in submitting bids. A short time later the owner began securing prime contracts for the production of shell fuse parts and has since obtained sub-contracts for various other small parts from a large prime contractor. As a result of these contracts his plant is now working twenty-four hours per day, six days a week and he is putting two machines back to work after an idleness of about five years. Incidentally, the power salesman induced the customer to install better lighting to help speed up production."**

# "One-Shot Treatment" Speeds Office Contacts

***Northwestern Electric Company renders fast, convenient service to customers calling by phone or at office — All facilities are spotted near the service clerks***

CUSTOMERS of the Northwestern Electric Company, Portland, Ore., formerly went to the counter to apply for service or other information, where the new customers went through the preliminaries and then the credit was looked up later, often necessitating another visit, phone calls or correspondence back and forth.

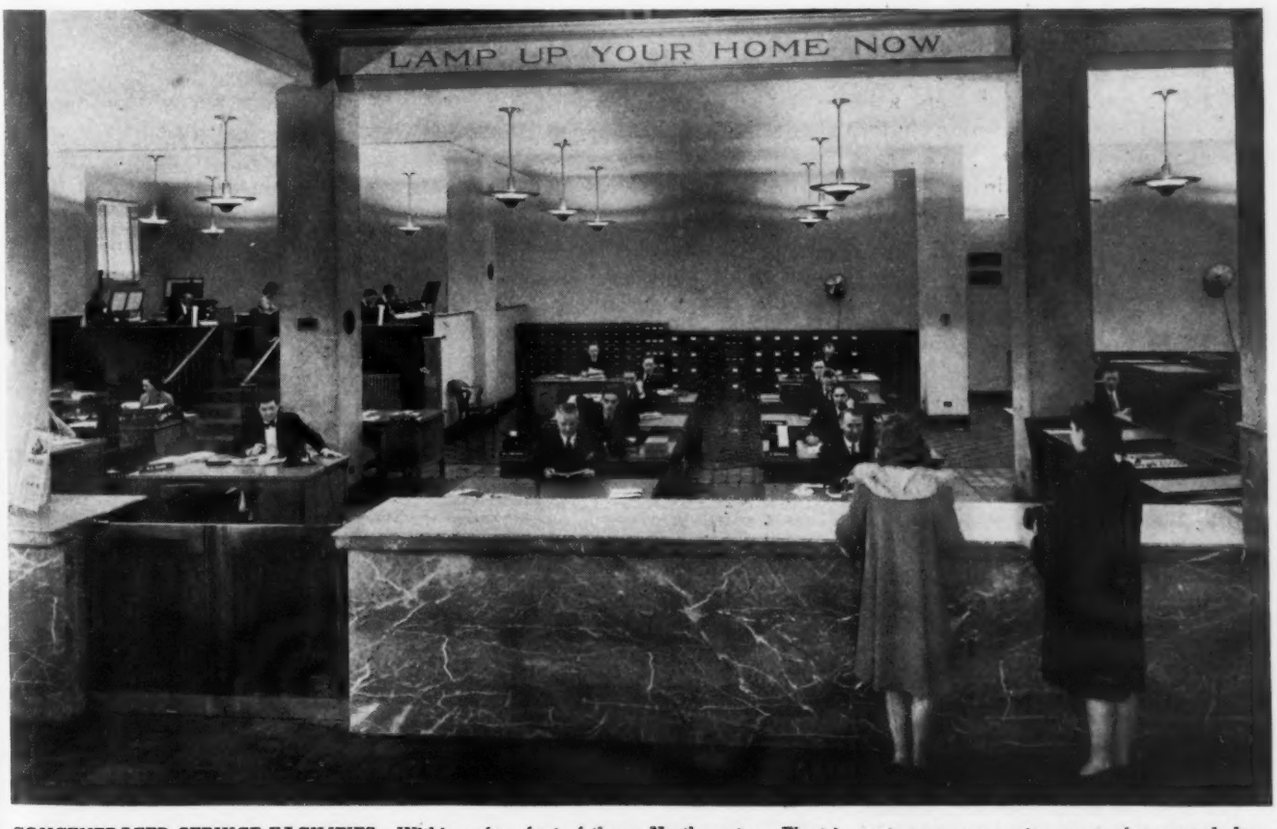
By a simple rearrangement of the front office facilities they are now given a "one-shot treatment" and every detail is cleaned up then and there. Ralph W. Lawler, assistant treasurer, planned the new set-up so that each customer service transaction or service can be completed at one contact on the spot.

Since the largest percentage of inquiries at the counter have to do with customer records, the ledger tub of service bills is placed next to the customer, with service location records adjacent. Applicants who wish to start receiving service are now, however, routed direct to the desk of the credit manager located near the counter. He handles the entire connection procedure in one interview.

Billing machines are located on a small rear balcony immediately above, with the balance of the billing section in the space immediately below. Hectograph and mimeograph machines are on the balcony.

An essential part of the single-contact program is the new telephone system for the customer's office force. It is known as the No. 4 turret system and is said to be the only one of its kind in the country, having been designed to meet specifications set up by Northwestern. By means of special keys and other equipment, three-way conversations are possible.

For example, the customer contact man, bookkeeper and meter department may make service arrangements at once. There is also an extra set of lights on the main switchboard, which relay information that enables the operators to provide quicker and more efficient service on incoming calls. Now the telephoning customer will never hear the outmoded "Will you please hang up and call again and ask for Mr. Blank? He's the man you should talk to, but I can't switch the call over."




**CONCENTRATED SERVICE FACILITIES—Within a few feet of these Northwestern Electric customers are customer service men, ledger tubs and service location records (at right), credit manager (at left) and billers (rear left). A unique telephone system also provides "one-shot treatment"**

# Static Capacitors Save Investment Dollars—II

*May permit postponement of major expenditures for new facilities — Cost nearly paid by savings in losses — Cheapest form of reactive capacity*

*R. G. HOOKE,* Public Service Electric & Gas Company*

THE shunt capacitor is a trump card for any engineer whose functions include planning system expansion projects to serve growing loads. Time and again he may find that costly reinforcements can be delayed by use of these devices to improve power factor, and when a particular expenditure in one area can no longer be postponed the capacitors may, at small cost, be moved to another location where a similar need is arising. Thus necessary "overbuild," the excess of capacity above that required for normal service plus spare facilities, may be reduced to a new minimum. This is highly advantageous in these times of tremendous load growth on some utility systems, with the ever-present threat of a future decrease in requirements, leaving surplus and unnecessary investment to be carried for a period of years, perhaps, after the emergency is past.

### *Investment Postponement*

From a comprehensive study it has been found:†

1. That in numerous instances reduction of 10 to 20 percent in loads can be achieved by power-factor improvement, with consequent major investment economies.

2. That coal-pile savings due to decreased kilowatt-hour losses may pay up to 90 percent of the cost of an initial program of capacitors, making their use to serve reactive loads highly economical in comparison with other methods.

All load-carrying electrical equipment is rated in kva. Reinforcements or additions to the system are therefore required when the loads, in kva., are likely to exceed the equipment ratings after all possible allowance for overload capacities, seasonal variations of ratings, etc. Since installations of static capacitors will cause minor reductions in kilowatt loads and major reductions in kilovar loads, it is evident that the application of capacitors to delay each new system addition must be investigated. It is found that distribution copper, substation transformers, subtransmission lines, bulk supply transformers and many other items can often be postponed for a year or more by their use.

As an example, some 30,000 kvar. (effective) in static capacitors has now been installed in one local area to make possible delay for one year of a major expenditure for a transmission switching station which will cost approximately one and one-fourth million dollars. Carrying charges on the capacitors, including gradual removal to a new location, will amount to less than $30,000 per year, compared with $190,000 per year for the switching station. According to the schedule, when this switching station becomes necessary in spite of the capacitors, these same units, moved to another area, will serve an identical purpose as conditions subsequently become critical.

In a more generalized study of another area complete subtransmission and substation plans were worked out for a fifteen-year future period according to a definite forecast of load growth and with various amounts of capacitors assumed installed. It was found that judicious use of the capacitors would reduce by at least one-half the cumulated annual carrying charges on the new facilities estimated to be required if no capacitors were used. This analysis covers an area with basic power factor of the load running from 65 to 75 percent, and assumed to continue so throughout the period of the study.

Again there is the case of a fully loaded substation with new transformers on order and scheduled for

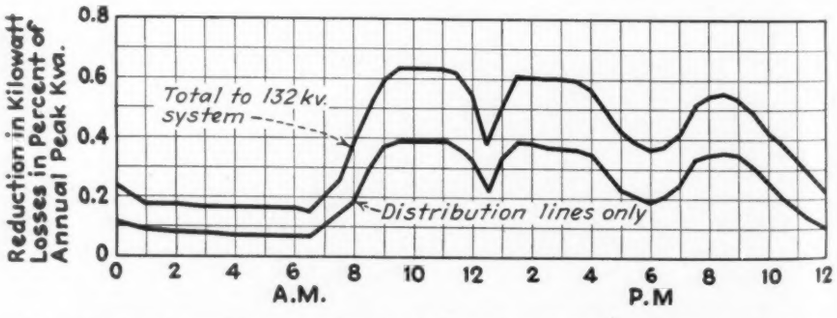



**FIG. 1—Avoided losses in other than distribution plant approach the value of savings in distribution losses.**

Switching station transformers, subtransmission lines, substation transformers and distribution circuits included. Chart for a typical September day with nameplate rating of capacitors equal to 10 percent of annual peak kva of the area.

* Transmission planning engineer.

† For a previous discussion of certain engineering aspects of a static capacitor program see "Static Capacitors Save Investment Dollars—I," by R. G. Hooke, ELECTRICAL WORLD, March 21, 1942.

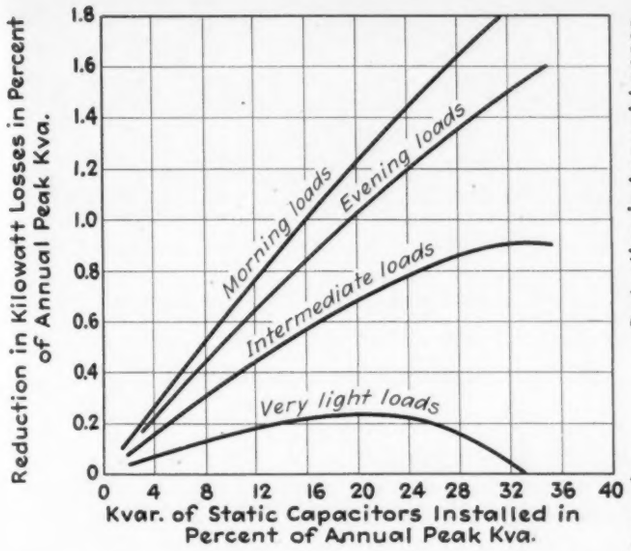



FIG. 2 (above)—Low-power factor morning loads show better loss reductions as capacitors are added.

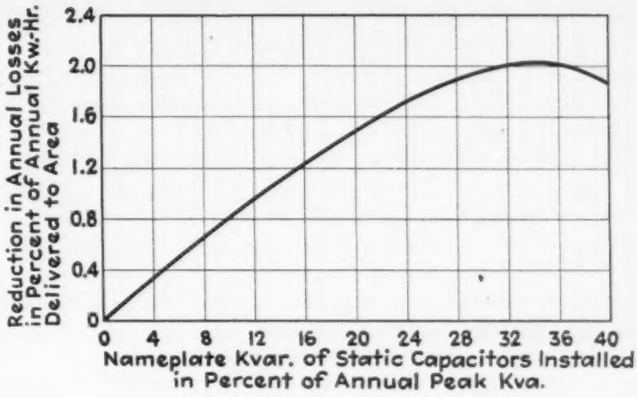

Reduction in Annual Losses in Percent of Annual Kw.-Hr. Delivered to Area
2.4
2.0
1.6
1.2
0.8
0.4
0
0 4 8 12 16 20 24 28 32 36 40
Nameplate Kvar. of Static Capacitors Installed in Percent of Annual Peak Kva.

FIG. 3—(top, right)—Optimum value of installed capacitor kvar for annual loss reduction may be between 30 and 40 per cent.

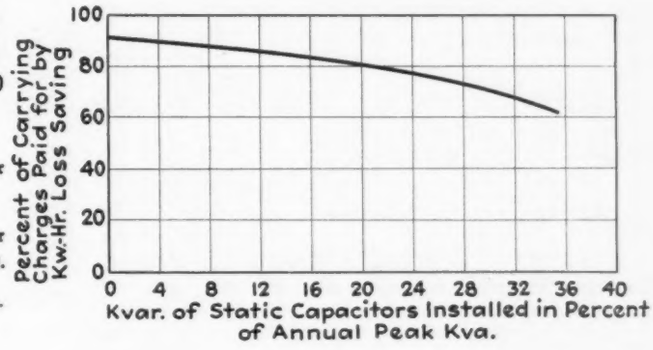

Percent of Carrying Charges Paid for by Kw.-Hr. Loss Saving
100
80
60
40
20
0
0 4 8 12 16 20 24 28 32 36 40
Kvar. of Static Capacitors Installed in Percent of Annual Peak Kva.

FIG. 5 (at right)—Coal-pile savings may pay from 70 to 90 percent of the installation cost of capacitors.

service six months hence. Suddenly pyramiding defense loads exceed all estimates by almost 1,000 kva. and inadequate spare is available in case of a transformer fault. Twelve banks of static capacitors are shifted into the area and by speeding up the new transformer installation satisfactory service remains assured.

### *Savings in Losses*

The over-all reduction in annual losses brought about by capacitors may be considerable, and a serious error is made if the studies stop at the low-tension substation bus or if only peak-load periods are considered. The savings in losses in the portions of the system on the load side of the 132-kv. source bus in a switching station are shown in Fig. 1.

The effect on losses of adding more capacitor units is quite different at different times of a typical day (Fig. 2). At light-load periods the maximum benefit occurs with a relatively small amount of capacitors added because unity power factor is reached. On the other hand, during the heavy load period in the morning (when power factor also is especially low) the loss reduction is almost directly proportional to the capacitors added and no maximum point is reached by the installations assumed.

Using this information (Fig. 2) a series of curves similar to Fig. 1 (top curve) may be drawn for various assumed capacitor installations, the area under each showing the reduction in losses for the day. This procedure may be expanded to cover a complete year by taking as many typical days as appear justified by the degree of accuracy required in the study. The final result will be a curve (Fig. 3) from which it is possible to determine the annual reduction in losses for any contemplated number of static capacitors installed. While this particular curve is based on a number of approximations necessary to shorten the labor involved, it is considered sufficiently accurate for use on the particular system for which it was developed. It is probably slightly conservative.

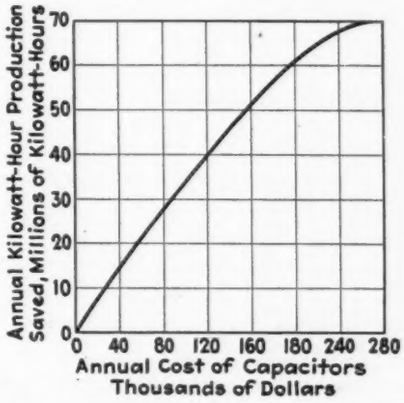



FIG. 4—Approximately 33 kw.-hr. saved annually for each dollar applied in shunt capacitors.

Physical limitations on distribution circuits and other factors, such as leading generator power factor at minimum loads, limit the amount of static capacitor reactive capacity acceptable on any system to between 10 and 20 percent of the system peak kva. This being the case, it is interesting to note from Fig. 3 that within this limit the savings in losses may be taken as very nearly directly proportional to the amount of such capacity installed.

### *Economic Justification*

Static capacitors may be installed on the system at a cost of approximately $6.85 per kvar. Carrying charges on this investment, estimated at 12 percent, which assumes a 25-year life, amount to $0.82 per year. Using these costs, and assuming a 1,000,000-kva. system with an annual output of 3,500,000,000 kw.-hr., Fig. 4 has been prepared. This illustrates a quantitative relationship between annual kilowatt-hours, the generation of which can be avoided by installation of capacitors, and the annual cost of the capacitors required to do it. Whether or not the expenditure for capacitors is justified will obviously depend on the increment cost of production of the kilowatt-hours. This is the coal-pile cost; as indicated in previous discussion of the effect of capacitors on kilawatt demand, no

demand cost is logically applicable.

By cumulating various increment kilowatt-hour generation costs over the annual load duration curve and comparing with the annual cost of the capacitors required to eliminate the production of these kilowatt-hours the final conclusion of this phase of the study is reached. For the particular area studied and the conditions assumed, coal-pile savings will pay about 90 percent of the cost of installation of the average static capacitors at the initiation of any program, the percentage falling off slowly as the program is enlarged (Fig. 5). Specific installations, of course, will vary from the average, in some instances being completely justified by loss savings alone.

### *Reactive Capacity Provision*

Since for every kilowatt of system load served from 0.5 to 1.0 kvar. must also be supplied, provision of system reactive capacity is of fundamental importance. This capacity may be provided in generators by specifying that they shall be designed for low power factor operation, at an increment cost which may approach $5 per kvar., or by purchasing synchronous condensers at a cost of $12 to $15 per kvar. Static capacitors, at a cost, effective at the generator and neglecting loss savings, of perhaps $\frac{\$6.85}{1.40} = \$4.90$‡ per kvar., are much cheaper than synchronous machines and certainly competitive with provision of the needed capacity in the generators. They are, of course, less flexible than rotating machines and subject to limitations as to the amount which can be installed. However, with growing loads placing increasing demands on generating equipment, they will often be found highly economical as a means of relieving generators of reactive loads, thus permitting increased kilowatt output merely by provision of more steaming capacity in stations and higher power-factor operation of machines.

Considering all the foregoing factors—the large proportion of their cost which is carried by savings in losses, the overall cheapness of the units as sources of reactive capacity, the possible release of kilowatt capacity in generators by power-factor improvement, the multitude of possibilities for reduction of kva. loads to keep within ratings of existing equipment in many parts of the system—it is easy to understand the extensive installation of static capacitors being made today by some large companies. It has even been suggested that their use by utilities placed on the system for maximum over-all effectiveness and at a cost for which compensation should be obtained from low power factor users might result in community economy superior to that achieved by rate clauses inducive to universal customer correction.

The author wishes to acknowledge indebtedness to J. H. Thompson, now district superintendent, Elizabeth district, Public Service Electric & Gas Company, for his painstaking and laborious work on many phases of the subject covered by this article.

‡ Ratio of effective capacitor rating to nominal capacitor rating assumed as 1.40.

# Motor Frame Designs Cause Maintenance Difficulties

*THOMAS TRAIL, Baltimore, Md.*

AT TIMES the writer, who has done considerable maintenance work on electric motors, especially direct-current motors, has wondered why designers do not seem to give sufficient consideration to frame details that will facilitate the work of repairing or maintaining the motors after they have been sold and put into service.

If considerable difficulty is experienced in working on a motor it is likely that the purchaser, or the workman whose duty it is to take care of maintenance on the motor, will feel rather unfavorably toward that type of motor, and if difficulties are encountered on more than one motor of the same type and make, it is quite likely that these things will be remembered if the occasion arises for purchasing one or more new motors of this type. For this reason the writer is unfavorably disposed toward the direct-current motors made by one of the largest manufacturers in the country and is not likely to recommend their purchase.

One make of direct-current motor that the writer has in mind is equipped with brush-holders which are so designed that it is difficult, especially where the brush-holder is located opposite one of the supporting bracket arms of the end bell, to loosen or tighten the brush lead terminal screw. Another make of motor has the brush lead terminal screws conveniently arranged on the brush-holder, but because of the position of the brush-holders in relation to the end bell supporting bracket arms it is difficult to loosen or tighten them without resorting to the use of a very short screwdriver or one of the flexible type.

The writer recalls an occasion lately when it was decided to purchase a 1-hp. direct-current motor to replace a ¾-hp. A certain make of motor was selected because of the reputation of the manufacturer for making quality products. After the motor was delivered it was noted that the design of the motor and the arrangement of the brush-holders was such that there was not enough clearance to permit one of the brush-holder arms to move sufficiently to permit the brush to be removed from the brush-holder without causing the brush-holder arm to strike the frame of the motor. Some direct-current motors are so designed that it is somewhat difficult to sand in brushes or to take proper care of the commutator.

Lack of clearance for the use of ordinary tools is also found on some motors. The writer had difficulty on one motor in tightening a loose brush-holder stud nut because of lack of sufficient clearance for the use of a straight end wrench. Even after a side-opening wrench was purchased it was not easy to tighten the nut. Difficulty was experienced in disassembling a motor recently because of lack of clearance to permit the use of any of a number of wrenches that were on hand to loosen the nuts holding the two end bells and the stator frame together. The only tool available that could be used was a pair of pliers.

# Appliances in Schools Build Future Demand

***Wisconsin plan puts electric equipment in 45 rural and small town high schools to cultivate tomorrow's customers — No expense to company***

*JOHN E. CANFIELD,* Wisconsin Power & Light Company, Madison*

CURTAILMENT in the production of major electrical appliances, existing today, suggests promotional activities that create deferred demand for load-building equipment. Under the circumstances a program of electric range installation in the home economics departments of public schools appears tailor-made for today's conditions. For by placing a relatively few units in the hands of high school home economics students mass acceptance of electric cooking equipment is engendered that will pay dividends when today's youngsters become tomorrow's customers, with homes of their own.

### *Program*

Through such a plan, which has cost the company no out-of-pocket money, Wisconsin Power & Light Company has installed 68 ranges, 20 refrigerators and numerous small appliances in 45 public schools in its territory, mostly in rural communities and small towns. Before the program was undertaken ranges under ten years of age were the exception. In one school modern home making was being taught with 18-year-old kerosene ranges. Ten years of depression and limited school budgets had much to do with this.

To correct this situation a plan was developed, in cooperation with manufacturers, that permit schools to buy and keep up-to-date electric appliances at no cost to the school after the original appliances are installed.

Under the plan only de luxe model ranges are offered, so equipment will have high resale value. Price of the appliance is determined as follows: To the utility cost is added 10 percent for stores, freight and handling, plus $2.50 for delivery. Thus with the usual 40 percent discount a range listing for $150 ordinarily costs the company $90. Under the plan the manufacturer offers 10 percent extra discount, so the utility cost is $75. Adding 10 percent for stores, freight and handling, plus $2.50 for delivery price to the school is $85—or less than the regular cost to the utility. Installation other than delivery is handled by the school board as a separate transaction.

Units will be replaced with new models of the same size if they are brought out as usual every year. Original equipment removed will be sold for the amount originally paid plus $7.50 for removal and delivery, plus 10 percent. Price of the above range after one year would be $85 plus $7.50 plus 10 percent of 101.75.

No trouble has been experienced in selling replaced equipment. Ranges are often sold to parents of students, since teachers are sometimes asked to announce availability of old equipment.

### *Small Appliances*

The plan is not restricted to major appliances, but covers small appliances as well, although the manufacturers do not offer extra discounts. Dealers can tie in with the plan too. If a dealer wishes, the company will "back out" so the local dealer can offer the plan and get the business. If the school board feels that the dealer may not be in business to continue with the plan, the utility will obligate itself to carry the plan in the future, provided the dealer's plan is the same as its own and, of course, that the dealer does go out of business.

Any manufacturer's product that the company regularly sells is eligible provided, in the case of major appliances, the manufacturer cooperates with the company by offering a special discount. If the school desires a particular brand of appliance every effort is made to secure it.

### *Enthusiastic Response*

Comments of teachers and students alike about the equipment are uniformly enthusiastic. Teachers at Fond du Lac, Wis., state, for example: "We believe youngsters have a feeling of satisfaction in working with good equipment. They take more pride in their work. The ease of working with new equipment encourages neatness and good work." That the plan builds popularity of the home economics is shown by one girl's comment: "Gee, I wish I had taken home economics this year since you got that new stuff." That it builds acceptance at home is testified by another who said: "When we get a stove we're going to buy one like this one because it boils water so much faster than the one we have at home."

**CHARLOTTE ROETHE, Cambridge, Wis., home economics teacher (right) instructs two future customers on use of the oven. This school has two electric ranges and one gas range**

* Assistant new-business manager.

# Editorials

S. B. WILLIAMS, *Editor*

## *Mr. Nelson on the St. Lawrence*

A FEW DAYS AGO Donald M. Nelson, chief of WPB, for the first time went on record as favoring the St. Lawrence power development as a war effort. He stated in a letter to Assemblyman Frank J. Caffery, of Buffalo, New York, who has been a leader in the opposition to this project, that he accepted the advice of W. L. Batt, director Materials Division, OPM, and J. A. Krug, chief of Power Branch, that the power part of the project should be authorized and constructed with all possible speed.

If this power is a vital need to the war effort we should have it, no matter who builds it. But when Mr. Nelson admits it will take four years he does not lend much strength to his argument. For two years he claims there will be very little critical material required. Doesn't he call transportation, and housing and trucks (with tires) and steel and labor and engineers and power critical war needs?

It wasn't so long ago that Mr. Nelson was urging first things first and above all speed. One plane this year, for instance, would be worth ten next year. What caused Mr. Nelson to come to the conclusion that power in northern New York State for war production in 1946 was urgent enough to sidetrack effort that could be useful in making planes in 1942?

We believed him when he said a few weeks ago that the next twelve months were vital to our success against the enemy. We still believe in that viewpoint. There is too much at stake now to be solicitous about 1946.

Mr. Nelson's statement is no more convincing than a host of others that have been made in support of this politically conceived project. It is unfortunate, because his position gives weight to any statement of that kind.

We have been admirers of Mr. Nelson for his forthright efforts in administering WPB and in spite of the fact that we take issue with him on this matter we shall continue to urge full cooperation with his office and staff.

We do not believe, however, that Mr. Nelson ought to allow himself or his office to be pushed into political situations, such as the Ark-La line or the St. Lawrence. Should he receive instructions from some higher authority then his conscience must be his guide; until then he would be better advised to let the politicians find their own salvation without his support.

## *Load Maintenance Is Still a Cost*

SOME UTILITIES in approaching the matter of appliance maintenance have been more than glad to turn this kind of customer servicing over to the dealer, because then the utility would be relieved of the cost. Companies that approach the problem on that basis are likely to have a severe jolt before they get very far with such a program. No matter who makes the repairs, the utility will have to spend money if the program is to be at all successful.

And why shouldn't the utilities spend money to hold business? Is there any reason why going business shouldn't have a sales cost? Perhaps it hasn't in the past, because it didn't seem warranted when so much better results apparently could be had from new business. But new business today isn't to be had with the same freedom as in the past; therefore, more attention must be given to load mortality, and that costs money.

How much money will it cost? That depends upon local conditions and the degree and frequency of customer coverage desired. Certainly the utility will have to do the promoting, and in most cases the selling. And once these costs are assumed many utilities will probably decide that it will be better in the long run to do the entire job.

There is no question that the job should be done. There is some question as to who should do it, how frequently, at what cost and what subsidies, if any.

## *Code Revision Inopportune Now*

WHILE there has been much discussion, there has been no final decision as to whether or not a new edition of the National Electrical Code will be brought out next year. A vote will have to be taken soon to learn if the majority favor the regular code revision due at this time.

While it is true that a lot of changes have been made and a lot more are pending—changes necessitated by war-time conditions—it is difficult to see what is gained by a major operation on the code at this time. Each day the restrictions are extended, and before long there will be no interior wiring permitted where no war necessity exists.

Changes that are necessary because of material shortages have been and should continue to be temporary for the duration. Such regulations can be covered by supplemental printed instructions. These, however,

are not code changes in the strict sense of the word; they are merely expedients.

However, such expedients are important in wartimes, and from them should be learned all that is possible. What are their qualifications and what are their limitations? If inspectors are charged with the responsibility of getting this information, then perhaps when the methods or materials come up later for code recognition we may enter the discussion armed with facts and not rely entirely on desire to have or not to have.

## E.T.L. Reborn

WE ARE PLEASED to announce in the news columns of this issue that the Electrical Testing Laboratories dissolved two months ago is reborn. For forty years this service to the electrical industry has been in existence, first as a lamp testing service when voltages were not easily predetermined and of late years as a broad service of tested performance under accepted standards.

Underwriters' Laboratories performs the useful function of testing to minimum specifications of safety. But this industry needs something more than minimums; it needs performance tests. That doesn't mean maximums or gold plating. It simply means that if certain industry standards of performance are right there should be some way to determine if equipment will give this required performance. Then when the buyer purchases something that is claimed to be made in accordance with certain standards he has a way of knowing if the claims are correct.

It is to be hoped that E.T.L. under the new ownership, the employees, will find ways of extending this quality control service even further in this industry.

## Original Cost Studies Touted as War Aid

RECENTLY in the Minnesota Power & Light case the Federal Power Commission stated that reclassification and original cost studies are an aid to the war effort. "The availability of such regulation," says the determination, "as a means of warding off the dangers of inflation in this field apparently led the Congress specifically to exempt the control of public utility prices from the provisions of the Emergency Price Control Act of 1942."

It is hard to believe that the commission which is usually so lucid and painstakingly careful in its statements should be so naive as to expect people to swallow that statement. Reclassification and original cost studies cannot help the war effort one iota. Rather by insisting on this work the commission is keeping men busy who might otherwise be doing some useful war work.

But the crowning touch is the implication as to why utility rates were left out of the Price Control Act. Surely the commission must know that they were left out because they are already regulated—for years they have been ceilings.

If and when inflation comes to utility rates it will be after the dam has burst and everything has gone sky high. If there is one thing in the world that utilities fear more than anything else it is inflation. With a regulated ceiling on rates a utility under inflation has no more chance than a man in a pit that is being flooded.

It would seem to us that when a regulatory body has to justify its actions in such a straw-grasping manner it is high time some one looked into the advisability of continuing such an operation for the duration.

## Alex Dow

KEEN intelligence—unimpeachable integrity—wide and diversified knowledge—Scotch shrewdness—salty humor—pungent expression—fluent speech, sometimes profane—aptness in Biblical allusion—indefatigable industry—business acumen—great engineering competence—courage to try the untried—mental and physical vigor to the end of his days.

Even without the customary placing of his name at the head of this tribute to a great man, those who knew him would recognize Alex Dow in the thesaurian collection of qualities and attributes recited above. The list is incomplete, but it amply identifies the man even to those who knew him only a little.

Without deprecating in the least his many and important contributions to the art and business of electricity supply, it may truthfully be said that Alex Dow will be remembered more as a personality than as an engineer or a business man. He had come to be "the Old Man" of the electric utility industry.

But his personality was backed up by solid achievement. When other men saw only small boilers for utility power plants, he saw big ones and he took the responsibility of having big ones built and installed in his company's generating stations. He fostered the development of the underfeed stoker. He originated or sponsored and put into use ideas that in the course of time developed into accepted practices of electric system operation; paralleling feeders, banking distribution transformers, loose linkage system ties between power stations at load centers, high-voltage underground cables, high-temperature steam and many others. He organized comprehensively and expressed clearly his own thoughts and the thoughts of other men in the early fog of argument from which, largely by his genius, there emerged sound axioms of utility rate making, financing and operating.

But what he did, as is to be said of all men, was the result of what he was. His accomplishments, his honors, never did obscure his personality. Now, when he is so lately dead, the man still stands in the foreground of the picture. It is not a great engineer, not a builder of an industry who is dead; it is Alex Dow.

## *Washington Comment*

By GEORGE E. DOYING, Jr.

# Allocations in Sight

THE priorities system is in for another major revamping which is intended to bring an end to the era of "blank check" ratings.

Approach of this "revolution" is heralded by the War Production Board announcement that the so-called Production Requirements Plan is to replace the use of general or blanket priority orders as "rapidly as the necessary new procedures can be put into effect"—by June 30, at the latest. The change is to apply to war factories as well as other industry—tank makers already have had to swap their own "P" order for the PD-25A form of application.

The principle behind the announcement is long overdue. In fact, a variation of the method, giving an even better end result, has been in force in the utilities' priority order for months and is today written into a number of other "P" orders—often working considerable sacrifice of position in the competition for scarce supplies.

Simply put, the revamping of priorities is an attempt to provide WPB with a positive and direct control over the amount of materials being consumed by a given volume of ratings. It is a pretty big step toward allocation, to a kind of middle ground between priority certificates and allocations. "P" orders generally grant blanket ratings to a particular industry to enable it to get materials needed for specified operations. More often than not there is no limit on the volume of ratings which can be issued, except a mild prohibition against excessive inventories.

### *"Checks" Outstanding*

WPB, in other words, under the blanket order system is in the position of knowing neither how many "checks" are outstanding nor how many "checks" will be issued in any month or quarter on an already overdrawn "deposit" of, say, copper. When the overdraft gets too big the "bank" closes and its assets have to be distributed to prior claims as long as there are any—that's allocation on the individual commodity level.

The Production Requirements Plan has been advanced as a cure-all. Under this procedure, originally unveiled last December and since then adopted by about 4,000 of the nation's 180,000 industrial plants, priority applications are made for a three-month period in advance with an exhaustive analytical showing of what is termed the "pattern" of the business on the books—the volume of A-1-a, A-2 and A-10 orders, a percentage breakdown by end use of the plant output and the exact volume of materials needed for each operation. One or more ratings are issued —for a specified amount of materials.

### *Not New to Utilities*

Utilities will see a certain relationship between this kind of control over materials and the Section F provisions of their own order, P-46, which antedates PRP in original draft. The P-46 Section F limits inventories, new material deliveries and use of materials to 100 percent of the dollar value of the inventory and use in 1940. Thus, by knowing what materials utilities did use in 1940, it is a simple process for WPB to compute the volume of "checks" utilities will issue against materials supplies in any one quarterly period or for a full year—not accurate to the last pound, of course, but reasonably close.

The PRP procedure works from the middle out to both ends. The rating is applied after a look at the end use of the products to be made and the relative urgencies of the ratings which have been attached to those products. Theoretically, at least, this supplies the same control over the outgo of raw materials as the Section F type of limitation.

Actually, both types of procedures should be useful to attain WPB's objective of materials control. For repair and maintenance priorities—or for any industrial operation where the consumption of materials can be measured in terms of some base of past experience—the P-46 type of order appears best equipped for the job. Thus, a rating is provided to be applied automatically for a specified amount of materials. The total of the "checks" to be issued is known at all times and can be provided for.

### *No Past Comparisons*

This system, however, won't work in providing for the munitions plants or for other factories where the ratio of materials consumption to output has been thrown completely out of gear by conversion. A P-46 type of order granting a refrigerator manufacturer the same type of materials he bought in 1940 up to 100 percent of the 1940 dollar volume would be useless for supplying an assembly line turning out machine gun carriages or shell cases. For this the PRP type of application, spelling out just what the plant expects to produce, is needed.

WPB, in its public proclamation of the forthcoming fundamental change in priorities, simply generalized with the statement that everything would be adapted to the PRP procedure. But even as this statement was being released, it was generating a heated dispute within WPB. The Materials Division, of which the Power Branch is a unit, is decidedly cool toward PRP; most of its "P" orders are primarily for repair and maintenance. Swinging over to some version of the PRP plan would necessitate scrapping adequate procedures with which both the WPB branches and the participating industries are familiar.

Just what the outcome of this procedural dispute will be it is too early now to say. Utilities, however, might do well to familiarize themselves with the PRP machinery and procedure. If PRP replaces P-46 it will mean that utilities will become obliged to file the PD-25A type of application each quarter to obtain ratings good for purchase of specified amounts of material, instead of simply applying their P-46 rating to orders up to a predetermined limit.

# NEWS OF THE WEEK

## MVEA Takes Up Utility Operation During War-time

***Variety of discussion topics include utility plant camouflage, utilizing existing equipment, reclamation of transformer oil, transformer cooling and aerial line mapping — Foresee use of diverse fuels***

Hardly a session of the Missouri Valley Electric Association's Engineering Conference in Kansas City last week failed to contribute some beneficial discussion of the effects of war-time conditions on utility operations.

Keith Martin, director Kansas City Art Institute, discussing camouflage of utility properties, said modern utility system camouflage is a matter for community coordination. It calls for deceptive hiding of highways, ponds, bridges and landmarks.

### *Transformer Overloading*

A. G. Johnson, Nebraska Power, said that in Omaha 20- to 30-year-old underground transformers that would otherwise be scrapped are being overloaded 50 to 75 percent where voltage drop does not become excessive.

Underground conferees disagreed heartily with a recent A.I.E.E. paper suggesting emergency cable operating temperatures of 120 deg. C. "Some," they reported, have been led by the paper to seek higher cable temperatures than was consistent with local ground conditions and economical cable life.

E. A. Swanson, Nebraska Power, reported use of scrap lead cable between ground electrodes and equipment in corrosive soil as an effective copper conservation measure. In discussion, extension of ground networks 6 to 8 ft. outside substation fences was recommended where fences are connected to station ground systems.

M. I. Kiern, Wallace & Tiernan, disclosed that with chlorinating capacity of 250,000 lb. per 24-hour day installed in central stations and industrial power plants (where there is no recirculation) 30,000 to 50,000 lb. of chlorine is being fed daily to 17,000,000 gallons of condensing water to combat micro-biological deposits.

Cost of reclaming transformer oil varies from 3 to 10 cents per gallon, depending on treatment used; with chemical neutralization the cheapest and best, according to Lawton M. Limpus, Oklahoma Gas & Electric. He reported extensive reconstruction of bushings to overcome design and operating difficulties; use of a series of adapter flanges to permit interchange of different makes of bushings between equipment; development of an approach to the effectiveness of the gooseneck distribution transformer bushing by proper wrapping and sealing of the semi-modern mushroom type, and the salvage of badly pitted breaker contacts by resurfacing with Sil-Fos and phos-copper.

Clyde Ray, Empire District Electric, cited tests on water cooling of transformers wherein a Michigan utility had carried 158 percent load on transformers sprayed with 20 gallons of water per minute at 23 deg. C. Ambient air temperature was 23 deg. C., humidity 55 to 60 percent, wind velocity

**MISSOURI VALLEY ELECTRIC ASSOCIATION sessions featured discussions on effect of war-time conditions on utility operations. Left to right are: C. E. Bathe, chairman electrical apparatus committee, and Fred Campbell, general chairman engineering conference; James Woodmansee, Electrical Engineers Equipment Co., and Lawton M. Limpus, superintendent of reclamation, Oklahoma Gas & Electric Co. The last-named discussed "War on Waste" at the engineering conference**

10 to 12 m.p.h., water temperature rise 6½ deg. C. and average maximum winding temperature 77 deg. C.

Aerial mapping of terrain for the 270-mile Omaha-Wichita 154-kv. transmission line permitted complete scouting of the route in seven days by two men. Estimates of line length from the pictures were accurate to ¼ mile, according to O. B. Curry, Kansas Gas & Electric. Modern construction methods and coordinated material supply attained a construction rate of 2 miles per eight-hour day. Construction crews were spaced 20 to 30 miles apart to minimize the effect of delays in one crew on those following.

Lubricating oils should be kept under lock and key; keys to all inclosures (particularly masters) should be limited in number, recommended C. H. Frier (Oklahoma Gas & Electric) in a discussion of war-time operating problems. D. D. Clarke (Kansas City Power & Light) said orthodox economics were out and that peaks may soon have to be smoothed by staggering and rationing.

Scheduling of units for winter overhaul is being extended from 24 to 30 or 36 months in Kansas City, reported H. L. Crain. Since 1935 the 60-cycle peaks are in the summer; war-time shifted the peak to the forenoon. Tire rationing is increasing the 25-cycle transit load and filling the valley preceding the evening peak.

***Feedwater Treatment***

Where raw water has wide variation the Zeo-Karb treatment appears to have wide application, said R. R. Briggs, in reporting three-year experience at the (100 percent make-up) South Omaha plant of Nebraska Power. After deaeration the water is not ferro-corrosive. Oxides have stopped graphitic corrosion of cooler and exchanger shells and heads. Treatment cost is 12 mills per ton of water.

War circumstances are likely to prompt use of diverse fuels, said M. H. Snodgrass (Detroit Stoker), in discussing the Roto-grate stoker, capable of also burning breeze, oat hulls, corn cobs or coffee grounds. Installations for boilers up to 200,000 lb. per hour have been made, one reporting 5 cents per month for maintenance over two years.

Watt-hour meters are essential tools in conserving fuel, copper and equipment capacities equally as effective as lopping leads, said T. A. Abbott, in announcing only two new General Electric meter developments. With none of the 1,362,000 lb. of aluminum in 1940 G.E. meters now available the alternative materials are providing acceptable characteristics.

# NEWS BRIEFS

WESTINGHOUSE VICE-PRESIDENT W. G. MARSHALL announced last week that more than 1,000,000 kw.-hr. per year will be saved for war usage by the company's decision to turn out electric signs at fourteen major Westinghouse plants. In addition, it was said, all electric signs will be "blacked out" at the company's 40 distributors' headquarters and 35 manufacturing and repair plants.

THE LARGEST CONTRACT in its history was recently executed by Florida Public Service, covering 500,000,000 kw.-hr. over an eight-year period for the new phosphate plant being erected near Fort Meade by International Agricultural Corp. to supply phosphates for both explosives and fertilizer.

ATLANTIC CITY AND SHORE RESORTS are asked to dim out boardwalk globes so that ships will not appear so sharply silhouetted for submarines. First device tried at Atlantic City is to paint the hemisphere of the globe which faces the sea.

CHICAGO LIGHTING INSTITUTE manager Carl W. Zerson names no less than 50 schools, women's clubs, Y.M. C.A.'s, churches, men's clubs, high school groups, councils, etc., to which lighting programs were presented from January 1, 1942, up to this week.

HELP WANTED BY TVA—more legally trained personnel for the land acquisition department to work on title abstracts and examination at from $1,800 to $4,600 per year.

A FINDING OF FEASIBILITY and his approval of the Bureau of Reclamation's report on the multiple-purpose Palisades dam project in Idaho has been transmitted to Congress by Secretary of the Interior Harold L. Ickes. The Bureau of the Budget authorized the transmittal of the report to Congress, but it informed the Secretary that no estimate for construction would be submitted during the current emergency unless it is demonstrated that national defense requires it. The proposed project calls for construction of a 260-ft. dam and 30,000-kw. hydroelectric power plant.

DREDGE FILLING onto the site of the Troutdale, Ore., aluminum plant will be handled by the General Construction Co., which will use the electric dredge Washington No. 3 for the work. The dredge is to be furnished power by the Northwestern Electric Co.'s floating substation. The all-electric dredge will use power taken from Northwestern's 66,000-volt Portland-Camas transmission line through a temporary substation. In addition to the substation, approximately ½ mile of 11,000-volt line will be built to deliver power at the river bank. The energy then will be taken by submarine cable to a floating substation moored alongside the powerful dredge.

•

## Nelson Urges Start on St. Lawrence

Start of construction on the power part of the St. Lawrence seaway project as an essential war need was urged this week in letters from Donald M. Nelson, chairman of the War Production Board, and a representative of Prime Minister W. L. Mackenzie King of Canada to New York Assemblyman Frank J. Caffery, a leader of the legislative group opposing the development.

In his letter Mr. Nelson said that he was "accepting and following the advice of William L. Batt, director of the Materials Division of the WPB, and of J. A. Krug, chief of the power branch of the Materials Division." He added that the project would require about four years for construction and "thus, most of the requirements for steel plate and all of the requirements for hydroelectric machinery would not come until 1944."

"In this way the drain on our supply of critical materials would be very low during the next two years, and if at the conclusion of that period the war is still on, we would still be in a position to make such changes in the program as the war situation might require."

Mr. Nelson's letter is the first instance that the WPB head has commented on the St. Lawrence development.

•

## Employees Negotiating Purchase of ETL Plant

Negotiations by the employees for the purchase of the plant and equipment of the Electrical Testing Laboratories, which went into voluntary dissolution as of January 27, 1942, after 40 years of operation, are reported as practically completed.

The same building, equipment and personnel would be involved in the new employee-owned corporation, organized in New York State under the corporate title of Electrical Testing Laboratories, Inc., for the purpose of instituting technical activities of the type in which they have been engaged as employees of ETL.

# WPB Specifications for Wire and Cable Issued

***Order states amount of rubber that may be used in manufacture of insulated wire and cable — Grade of insulation and jacket for different applications specified***

Specifications setting forth the maximum amount of rubber which may be used in manufacturing insulated wire and cable after April 1 and the grade of insulation and jacket to be used for different purposes are contained in Amendment No. 2 to Order M-15-b-1 issued by the War Production Board.

Insulations and jacket compounds are divided into four classes. Grade A insulations (ASTM D-353-1941) may contain 55 percent rubber and 14 percent scrap, Grade B (ASTM D-353-Emergency ASTM D-574) 35 percent rubber and 18 percent scrap, Grade C (Code Grade 2/11/42) 13 percent rubber and 60 percent scrap. Jackets (Grade D) are permitted 80 percent crude and 35 percent scrap.

***Applications Permitted***

Grades B and C are permitted for building wire and general service in dry locations, with Grades A and B permitted in wet or damp locations, depending upon operating voltages. Jackets are not allowed. Grade A is available to general service at copper temperatures above 60 deg. C., for motor leads and for severe mechanical conditions, but again without jacket.

Portable heavy-duty service for power shovels, dredges, mining locomotives and machinery, welding machinery and power leads, portable drills and tools, electrically driven construction machinery and oil well exploration cable is eligible for Grade B insulation and jacket. Portable appliance service cords must use Grade C without a jacket, except that a jacket may be used in the manufacture of three-conductor type POEJ-32 cord for use between wetproof heating pads and heat control switches. Grade C insulation is permitted as a jacket for PWP cord.

Compounds used in manufacturing cable tape shall contain no crude and not more than 80 percent scrap and may be applied only to one face. Rubber in any form is banned for insulation for a neutral wire or a grounded neutral system. Rubber jackets, belts and sheaths are prohibited except on the portable power equipment specified.

WPB estimates the new specifications will save 3,750 tons of crude rubber annually, 37½ percent of normal consumption. The wire and cable "specs" are the third established for rubber products—tires and tubes and footwear being already in effect.

•

## Navy-Bonneville Pact

Contract has been executed between the Secretary of the Navy and the Bonneville Power Administration for delivery of electrical energy to naval establishments in the Puget Sound area, Paul J. Raver, Bonneville Administrator, has announced. "The navy will purchase the power at Bonneville's $17.50 per kilowatt per year rate, and provision has been made for interchange of dump energy," Dr. Raver said.

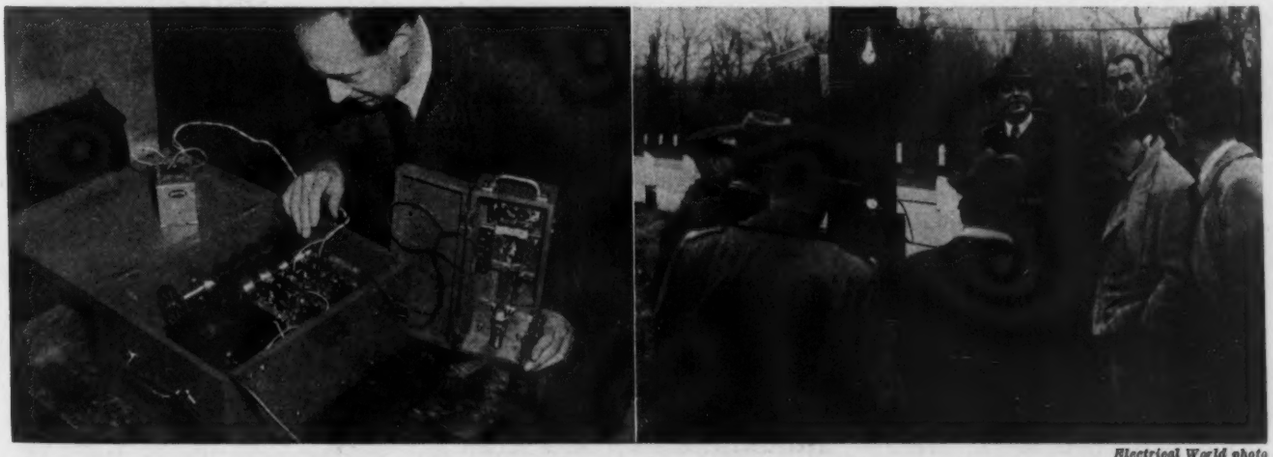
•

## Emergency Tie-In Authorized by FPC

In its first order issued under Section 202(d) of the Federal Power Act since War was declared, the Federal Power Commission this week authorized construction of a permanent interconnection near Somerset, Mass., between the facilities of New Bedford Gas & Edison Light Co. and those of Montaup Electric Co.

The order states that the connection, of at least 25,000-kva. capacity, will provide for the interchange of electricity between the two companies to assure an adequate and continuous power supply for war industries in the territories they supply in southeastern Massachusetts, and that it is in the public interest, "particularly in view of present war conditions and the importance of war industries served by New Bedford and Montaup."

Connection will consist of approximately 20 miles of 110-kv. transmission line, including a river crossing over the Taunton River, switching equipment, and a transformer at the Acushnet substation of the New Bedford company, at a total estimated cost of $1,093,300, with corresponding estimated annual operating costs of approximately 12 percent of the capital cost, or about $131,200.



*Electrical World photo*

**BLACKOUT CONTROL—Engineers from neighboring utilities, representatives from the Signal Corps and the Office of Civilian Defense listen as Paul Lazard (right), Defense Control Systems of America, explains the operation of a low-frequency blackout control system ("Electrical World," December 27, 1941, page 84; March 7, 1942, page 74), demonstrated on a 4,800-volt underground delta system of an Eastern utility. Pendulum-relays turn a test lamp on and off in response to low-frequency, 2½-milliamp. impulses from the transmitter (left) in the substation, some seven miles distant; two radio batteries, about 25 volts total, serve as voltage supply at the station. Dr. Robert P. Rudin, inventor of the system, points out the features of the test transmitter (left)**

# Blackouts Cause Little Disruption in Vancouver

***No curtailment of retail or industrial business in coastal area north of the boundary — Entire program based on permanent external blackout except for shipyards***

While war-time blackout regulations on the Pacific Coast have, to some extent, affected every field of retail business and industry, at the same time comparatively little disruption of business has resulted and actually the situation is much less serious apparently than is generally believed to be the case on the eastern seaboard. The effect of blackouts has really been one of cutting down promotional activities for the sale of merchandise rather than curtailing the actual operation of retail business or general industry.

### *External Blackout*

The entire section of British Columbia, west of the Cascades, is included in a blanket order which prohibits any window display lights after business hours and entirely bans the use of outdoor illuminated signs, porchlights, etc., after sunset. While these regulations are the subject of protests by merchants and other interests, especially those connected with the advertising industry, they in no sense affect the operations of vital war industries. Shipyards, for example, are continuing to operate as formerly, with big floodlights playing on the stocks and jibs and shifts continuing throughout the night hours as formerly.

Blackouts have not been ordered in British Columbia since the three successive nights which followed immediately on Japan's advent into war, but all business men have taken definite precautions to meet the possibility of blackouts being ordered at any moment. Some firms have resigned themselves to closing down operations if such an emergency should arise, but in the main industrial plants have taken steps in the prompt blacking out of all windows, and this is particularly true in the case of war industries.

### *Commercial Lighting Hit*

While shipyard lights are allowed to remain on, other types of outdoor lighting, such as the illumination of service stations, have been banned. Theatre lobbies are lit, but the exterior of the premises is in complete darkness. One dance hall in Vancouver is observed to use a new type of floodlight in the illumination of the exterior of the building. This is suspended on wires in front of the building, is of low wattage and is hooded so that the full light is focussed on the walls of the building, striking below the roof line and terminating before it reaches pavement level.

### *Automobile Control*

Automobile traffic is now operating on a normal basis after many very considerable misunderstandings. Regulations now require a 3x¼-in. horizontal slit in headlights below the center of the beam. The Vancouver City Council is objecting to the use of blackout paint on headlights and demanding that the regulations be changed requiring a removable mask for car lights. Cars which have blackout material on their lights are restricted to a speed of 15 miles per hour when a blackout is not in effect and during blackouts all cars are slowed down to this speed.

Street cars have met the situation by installing blue lights in destination signs and at entrances, while a certain number of the regular lights have been replaced by blue units and during blackouts only these darkened lights are used.

Meanwhile, formal protest against "dim-out" regulations in the interior of British Columbia, and particularly in Penticton, B. C., has been voiced in a letter sent by the Penticton City Council to the Attorney-General of British Columbia. According to this letter, such regulations prohibiting illuminated signs and store window displays are unnecessary in the interests of national defense and are imposing a burden on municipalities through reduction of revenue of municipal power and light systems. The letter also referred to a statement of Lorne Campbell, president West Kootenay Power & Light Co., to the effect that his company in event of an air raid would pull its main switches and thus completely blackout the entire interior of British Columbia.

•

## Rainfall in St. Louis Area Is Aid to Union Electric

Rainfall in the St. Louis district is permitting full operation of hydro-electric plants. This has permitted Union Electric Co. of Missouri to take certain steam plants out of service for overhauling; one 75,000-kw. unit was out for a month, it is reported.

Indications are also seen that war-time has proved a power saver. While February's kilowatt-hour production was a record, the peak demand—around 593,000 kilowatt-hour—was below the 619,000 kw. record of last November.

•

## REA Copper Supply Curtailed by WPB

The War Production Board made a "final" disposition of Rural Electrification Administration projects in a formal ruling this week over the signature of Chairman Donald M. Nelson.

The order directs that 550 tons of copper which REA has on hand for projects which cannot be started be switched to nearly completed projects. This copper, with a final allocation of 100 tons from WPB now, is to end all REA line construction (except any war work) for the duration.

The order also rescinds the seven-month allocation of 1,500 tons of copper monthly made to REA last December by the old Supply Priorities and Allocations Board to complete projects then 40 percent built. A total of 7,200 tons has been earmarked to REA under this deal, out of a possible total of 10,500 tons.

The 7,200 tons already allocated, plus the 650 tons diverted or allowed by Nelson's order, will complete all the REA work which SPAB undertook to underwrite in the December "settlement," WPB announced.

•

## House Rejects All Allotments for NPPC

The House of Representatives has rejected all appropriations to continue the National Power Policy Committee in the fiscal year beginning July 1. Elimination of the $28,500 allotment for the committee came during consideration of the huge Department of Interior appropriation measure.

In the same action the House reduced the general allocation for the Secretary's office to eliminate the $8,000 salary for Stephen Raushenbush, chief of the research branch of the power division, and $100,000 for salaries for 40 employees in the Ickes information service. Mr. Raushenbush was bitterly attacked for his "Socialist" writings by Congressman Winter, Republican, Kansas.

Technically, the House action does not necessarily end the NPPC's exist-

ence. It was set up originally by executive order of the President and could be continued with funds from his own accounts.

•

## Utility Shuts Down 37-Year-Old Plant

After generating electric power for 37 years, during which the number of its customers increased from twelve to more than 500, the Mill Street plant of the Ellicottville Electric Light Co. has ceased regular operations. Under terms of a contract entered into with Niagara, Lockport & Ontario Power Co., the Ellicottville Electric Light Co. will continue to provide retail distribution to its customers of the power which it will now purchase.

According to President Joseph K. Lowry of the Ellicottville company, the decision to replace the company's power generating equipment, including one steam, one hydro and two Diesel-generating units, with purchased central station power was reached "after careful study and consideration of all the economic factors involved."

Power from the Niagara, Lockport & Ontario Power Co. will be received over a modern three-phase, 33,000-volt transmission tie recently built by the company from a point on its transmission loop near Little Valley to the corporate village limits of Ellicottville, a distance of 6¾ miles.

# North American Budget Up 45% Over Year Ago

***Construction programs schedule 240,000 kw. for 1942 — Union Electric adding 40 percent to installed capacity to serve war loads — Emergency halves expansion time***

Construction programs of North American Co.'s consolidated subsidiaries amount to more than $65,700,000 for 1942, as compared with expenditures of $45,200,000 in 1941 and $25,000,000 in 1940, according to Edward L. Shea, president.

It is estimated that approximately $46,100,000 of the total will be spent this year and the balance in 1943, Mr. Shea added. These construction programs will be carried out as planned, he continued, "unless there should be serious interference with schedules for delivery of materials and installation of equipment."

### *Union Electric Program Largest*

Largest single construction program of a subsidiary is that of Union Electric Co. of Missouri, which is expanding its installed capacity by 240,000 kw., or 40 percent, to meet the growing needs of war production in the St. Louis area. According to J. Wesley McAfee, president of the utility, "our normal expansion program planned originally for five or six years is being accomplished in half that time because of the war."

The first 40,000-kw. turbo-generator for the utility's Venice No. 2 plant, begun in June, 1940, is now in production and a second similar unit is scheduled to begin operation this month. About 1,000 men are now at work on the second section of this plant, which will provide another 80,000 kw. and is scheduled for completion in the fall of 1942. Another 80,000-kw. unit has been ordered for the third section of this plant, which is planned for completion late in 1943.

Other major construction programs of North American's consolidated subsidiaries include: The Cleveland Electric Illuminating Co., 60,000 kw. in 1942 and 50,000 kw. in 1943 (60,000 kw. added in 1941); Wisconsin Electric Power Co., 80,000 kw. in 1943 (35,000 kw. added in 1941); Kansas Power & Light Co., 15,000 kw. in 1943; Missouri Power & Light Co., 5,000 kw. in 1943 and 5,000 kw. in 1944, in addition to the 5,000-kw. addition last year; Wisconsin Michigan Power Co., a new 14,000-kw. hydro-electric plant in 1942.

Construction program of Potomac Electric Power Co., whose accounts are not consolidated, calls for a 50,000-kw. addition in 1942 and two other units of the same capacity, one each in 1943 and 1944.

**CENTRAL STATION POWER will be supplied from the Niagara, Lockport & Ontario Power Co. to this new 1,000-kva., 33-kv. substation built by the Ellicottville (N. Y.) Electric Light Co. when the latter utility shuts down its 37-year old plant. Looking over the new transformer structures are, left to right, Roy S. Allison, district manager of Niagara, Lockport and Ontario Power, and Joseph K. Lowry, president of the Ellicottville company**

•

## Submerged Weir Will Give More Power from Niagara

Construction of a submerged weir in the Canadian channel of the Niagara River just above Niagara Falls will be started soon to divert additional water into the American channel for power purposes and to preserve the beauty of the cataract.

The long-discussed project has been agreed upon between the United States and Canada and work will be completed before the end of the year, according to official sources. The plan provides for an underwater dam about 2,000 feet long between Canada and a new island to be created 2,000 feet upstream from Goat Island. No estimate of the cost was made known but the expense will be divided between the United States and Canada. The two governments will do the work.

## A.S.T.M. Changes to Meet Emergency

Changes in specifications and test methods to keep them as closely as possible in line with existing emergency situations were taken by several committees during the recent American Society for Testing Materials Committee Week in Cleveland.

Final agreement was reached on changes in the preliminary draft of the proposed specifications for lead and lead-alloy coated electrical conductors and it was agreed to submit the specification with these changes for acceptance as an emergency standard.

Emergency changes in the interest of conservation were suggested by the committee on rubber products. These actions include a reduction in the electrical and physical properties which must be met by the rubber compounds for insulated wire and cable, class "AO," 30 percent "Hevea" type, with related action in heat-resisting rubber compound wire and cable and the ozone-resistance type of insulation.

Approval was given to a provision that a cable tape needs to be frictioned only on one side, instead of the present requirement of both sides, with an insulated compound that is not injurious. As an example of reduction in physical properties in "D 353-41, Performance Rubber Compounds," the tensile strength for rubber insulation is being reduced from 1,200 to 850 psi. and the electrical constant from 4,000 to 2,000.

•

## P.U.A.A. to Continue Better Copy Contest

Confirming its belief in the importance of advertising on the wartime business scene, the Public Utilities Advertising Association recently announced continuance in 1942 of its annual Better Copy Contest to select outstanding example of utility advertising. This year's contest, for which entries must be mailed by April 14, is but one phase of the association program to gear better advertising to the present national emergency.

This year, as for the past two, the Better Copy Contest will be conducted on a regional judging basis. Preliminary contests will be conducted for each of the seven regions in which the country is divided. Regional winners will compete for a national award. Regional and national awards will be given for eighteen classifications of utility advertising ranging from complete campaigns in newspapers to radio and employee publications.

The contest is open to all utility companies whether members of the association or not. Rules and regulations governing the contest, mailed to members of the association last week, stated that all entries must be in transit to designated regional chairmen by April 15. Copies of the rules governing the contest may be secured from R. I. Seymour, advertising manager of the Kansas City Power & Light Co., Kansas City, Mo., and national chairman of the P.U.A.A. Better Copy Contest Committee.

## MEETINGS

**Midwest Power Conference** — Annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles A. Nash, conference secretary, Illinois Institute of Technology, Chicago, Ill.

**Missouri Association of Public Utilities**—Annual convention, Jefferson Hotel, St. Louis, Mo., April 14-15. Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

**Electrochemical Society**—Spring convention, Hotel Hermitage, Nashville, Tenn., April 15-18. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

**Southeastern Electric Exchange**—Annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 16-17. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

**Northwest Electric Light and Power Association**—Engineering and operating section, Olympic Hotel, Seattle, Wash., April 23-24. Berkeley Snow, executive secretary, 418 Spalding Bldg., Portland, Ore.

**Maryland Utilities Association** — Spring meeting Lord Baltimore Hotel, Baltimore, Md., April 24. Wilson Cook, secretary, Potomac Edison Company Bldg., Frederick, Md.

**Association of Iron and Steel Engineers**—Spring conference Royal Connaught Hotel, Hamilton, Ontario, Canada, April 27-28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

**Chamber of Commerce of the United States** — Annual meeting, Washington, D. C., April 27-30.

**American Institute of Electrical Engineers** — North Eastern District, Schenectady, N. Y., April 29-May 1; summer meeting, Chicago, Ill., June 22-26. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

**National Fire Protection Association** — Annual meeting Chalfonte-Haddon Hall, Atlantic City, N. J., May 11-15. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

**Arkansas Utilities Association**—Annual convention, Arlington Hotel, Hot Springs National Park, Ark., May 18-19. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

**National Metal Trades Association**—Annual convention, Biltmore Hotel, New York, N. Y., May 19-20. Harry S. Flynn, secretary, 122 S. Michigan Ave., Chicago, Ill.

**Missouri Valley Electric Association**—Accounting conference, Hotel Continental, Kansas City, Mo., May 21-22. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

**Pacific Coast Electrical Association**—Annual convention, Fairmont Hotel, San Francisco, Calif., May 21-22. Victor W. Hartley, managing director, Edison Bldg., Los Angeles, Calif.

**National Association of Purchasing Agents**—Annual convention, Waldorf-Astoria Hotel, New York, N. Y., May 25-27. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

**American Society of Mechanical Engineers**—Semi-annual meeting, Statler Hotel, Cleveland, Ohio, June 8-10. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

**American Society of Heating and Ventilating Engineers**—Semi-annual meeting, St. Paul Hotel, St. Paul, Minn., June 15-17. A. V. Hutchinson, secretary, 51 Madison Ave., New York, N. Y.

**American Society for Testing Materials**—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

**Canadian Electrical Association**—Annual convention, Manoir Richelieu, Murray Bay, Que., June 25-26 (tentative). B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal, Que.

## WPB Relaxes Ruling on Line Extensions

Aid to utilities for completing new connections which have been stymied by priority regulations was announced this week by the War Production Board Power Branch.

New extensions up to 2,000 ft. will be permitted to connect homes which were wired prior to March 26 or to connect new houses the foundations for which were complete on March 26, where the utility specifies that galvanized steel wire will be used instead of copper.

Projects within these specifications are not automatically approved. Utilities must write a letter to the Power Branch of the WPB outlining the job and receive an authorization before going ahead.

Intent of the policy is to permit connection of homes denied electricity as a result of the 1,000-ft. line restriction imposed last December 5 and the sudden quartering of that limit to 250 ft. on March 26.

•

## Cohn Elected President of Baltimore Utility

Charles M. Cohn, executive vice-president of the Consoliated Gas, Electric Light & Power Co. of Baltimore, was elected president of the company at a recent meeting of the board of directors to succeed Herbert A. Wagner. Mr. Wagner, who has been president since 1915, will continue to act as chairman of the board, a position he assumed in 1939 in addition to the presidency.

William Schmidt, Jr., a vice-president of the company, was made executive vice-president to succeed Mr. Cohn. Ralph L. Thomas, executive engineer, was elected a vice-president and J. T. Wolfe was elected assistant vice-president.

•

## Metal Fittings Limited for Home Installation

A new defense housing "criticals list" issued by the War Production Board this week prohibits use of armored cable, metallic cable, metallic raceways and metal outlet boxes in new home construction except where other methods are prohibited by the National Electrical Code.

The new list also bans private telephone systems in multiple dwelling construction and eliminates use of copper coils for hot water generators and heat exchangers.

## Decrease in Output More Than Seasonal

In the week ended March 28 a total of 3,345,502,000 kw.-hr. was distributed by the electric light and power industry of the United States—12.4 percent more than in the corresponding week a year ago, according to the Edison Electric Institute.

The decrease from the immediately preceding week of some 11,000,000 kw.-hr. was seasonal and the percentage change—roughly a third of 1 percent—was only slightly greater than in previous years.

Major geographic regions shared the slight decrease in percentage changes from 1941 during the week ended March 28. In three instances, however, gains in this respect were shown. And the 28.8 percent gain for the Pacific Coast area was second only to the 29.1 percent mark registered in the week ended March 14.

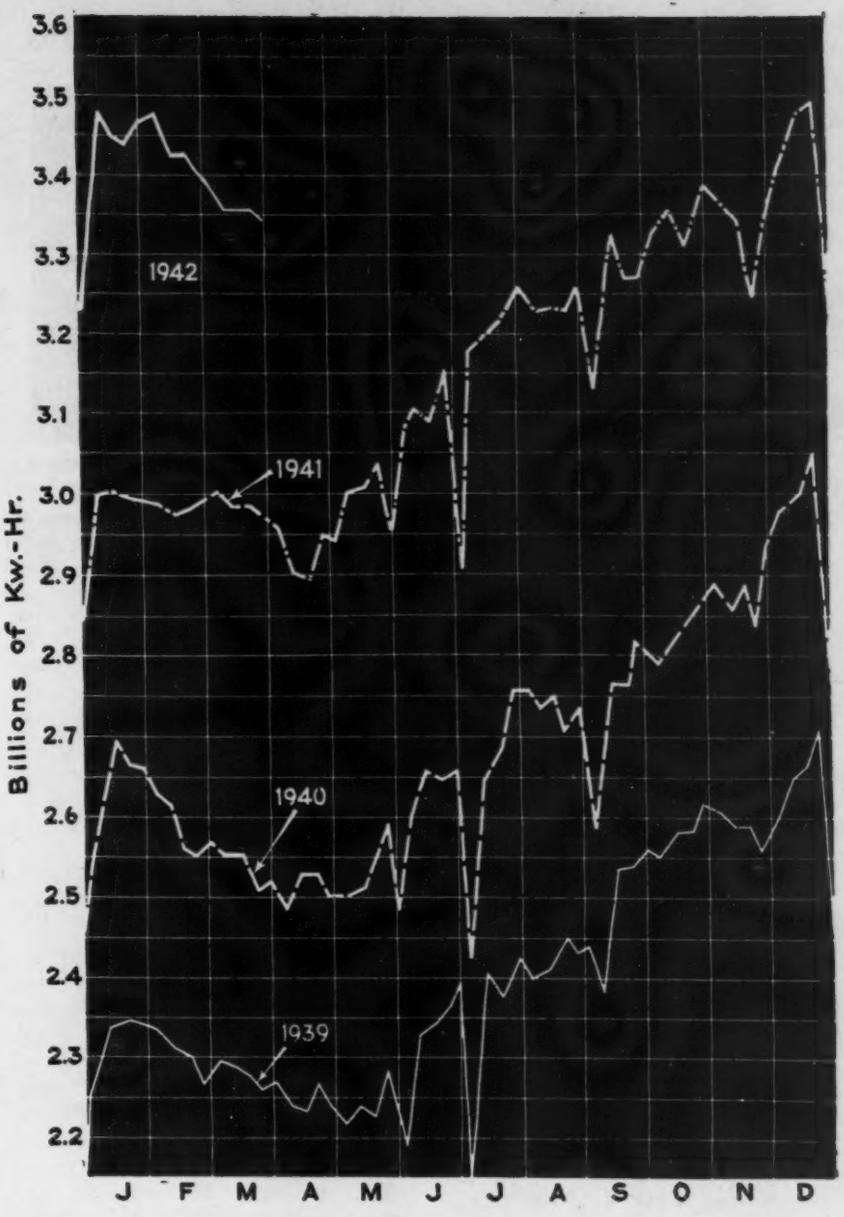
**Weekly Output, Millions Kw-Hr.**

| 1942 | | 1941 | | 1940 | |
|---|---|---|---|---|---|
| Mar. 28 | 3,346 | Mar. 29 | 2,975 | Mar. 30 | 2,524 |
| Mar. 21 | 3,357 | Mar. 22 | 2,983 | Mar. 23 | 2,508 |
| Mar. 14 | 3,357 | Mar. 15 | 2,984 | Mar. 16 | 2,550 |
| Mar. 7 | 3,392 | Mar. 8 | 3,005 | Mar. 9 | 2,553 |
| Feb. 28 | 3,410 | Mar. 1 | 2,993 | Mar. 2 | 2,568 |
| Feb. 21 | 3,424 | Feb. 27 | 2,986 | Feb. 24 | 2,547 |
| Feb. 14 | 3,422† | Feb. 15 | 2,976 | Feb. 17 | 2,565 |
| Feb. 7 | 3,475 | Feb. 8 | 2,989 | Feb. 10 | 2,616 |
| Jan. 31 | 3,468 | Feb. 1 | 2,994 | Feb. 3 | 2,633 |
| Jan. 24 | 3,440 | Jan. 25 | 2,996 | Jan. 27 | 2,661 |

**Percent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Mar. 28 | Mar. 21 | Mar. 14 |
| New England | + 9.8 | +10.4 | +10.7 |
| Mid-Atlantic | + 8.4 | + 9.2 | + 8.3 |
| Central Industrial | +10.1 | +11.0 | + 9.9 |
| West Central | +12.4 | +12.7 | +11.6 |
| Southern States | +11.7 | +10.9 | +12.6 |
| Rocky Mountain | +13.6 | +13.4 | +13.2 |
| Pacific Coast | +28.8 | +27.2 | +29.1 |
| Total United States | +12.4 | +12.5 | +12.5 |

† War-time began.




## Three WPB Orders Affect Appliances

The War Production Board issued three orders this week affecting electrical appliances and their manufacture.

The $60,000,000 electrical appliance industry was ordered to halve all production for the duration on May 31. Production quotas of 1½ times the 1941 rate apply for the last two months. No rationing program was indicated; stocks will be sold through regular channels until they are exhausted. The order affects appliances using fractional-horsepower motors and up to 2,500-watt heating units, including elements for new ranges. Notably excepted are fans.

Another order permits retailers to sell their entire stock of new electric refrigerators, relaxing the "freeze" order quota imposed when that industry was ordered to discontinue production and convert to war work. Distributors, under the new arrangement, may sell stocks back to the manufacturer, or, if they maintain a retail department, sell a portion of the supply at retail. Manufacturers' stocks remain frozen to await a rationing program. It is estimated that the relaxed rules will permit unrationed retail sales of about 75,000 more units than under the first order.

The third order opens the way for refrigerator manufacturers to sell partially fabricated inventories to the Defense Supplies Corp. or Metals Reserve Co. for processing into scrap metal.

•

## Conversion Aids Utility

Conversion of the automobile industry to armament production is apparently proceeding well ahead of schedule. While definite data are not available for obvious reasons, it appears that by July of this year Detroit Edison Co. will have regained a substantial part of the business lost by curtailment of auto production.

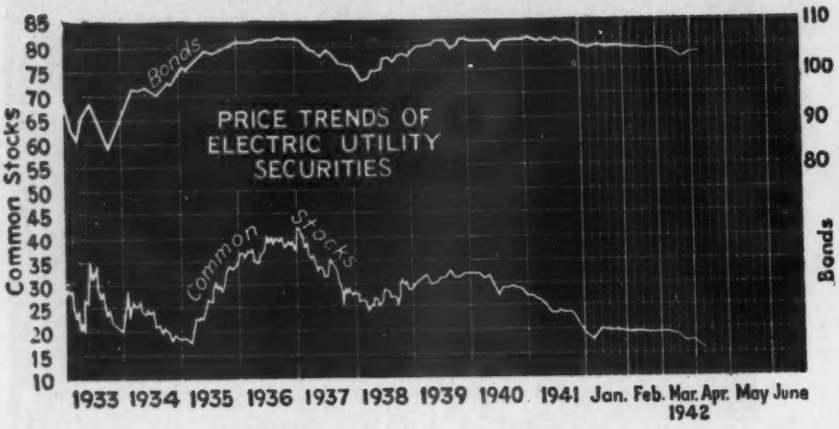
•

## "Stay in the Industry," Appliance Dealers Told

Appliance servicing, adequate lighting business and tieing in with the war effort by selling farm equipment which is badly needed and is getting priority recognition are dealer suggestions by J. F. McAllister of the residential sales department of Utash Power & Light Co.

These suggestions won Mr. McAllister an award in a recent contest sponsored by the sales education section of General Electric Co.'s appliance and merchandise department.

## Utility Stocks and Bonds Continue Downward


Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Common Stocks
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

**Reflecting the general market trend, utility securities continued downward during the past week. "Electrical World" stock index dropped to 17.1 from 17.5 the previous week; last year, 25.8. Bonds dipped to 102.7 from 102.8 the previous week; last year, 106.0**

## Requests Overruling in Loup River Case

Attorneys for the Loup River Public Power project in Nebraska have asked the state supreme court to overrule the finding of District Judge Chappell that it was not entitled to relief sought in an injunction action against the North and Middle Loup Public Power Districts because it had an adequate remedy at law and because the court had no jurisdiction over the subject matter. Twenty-nine reasons were listed why the relief should not be granted.

In 1934 the project was granted an appropriation of waters of the Loup River, not to be exercised until after North Loup had used 38,000 acre-feet and Middle Loup 45,000 feet. On the basis of that grant $12,000,000 was invested in generating plants. It was charged that the two irrigation districts have been taking more than they were entitled to and that the state officers not only permitted but aided them to do so.

•

## Prudent Investment Actions Follow U. S. Court Ruling

Following the recent ruling of the United States Supreme Court upholding the "prudent investment" method of fixing rates (ELECTRICAL WORLD, March 21, 1942, page 93), The Michigan Public Service Commission announced that it will take the initiative in reviewing Michigan's gas and electric rates. Chairman Richard H. Barkell said the commission had instructed all utilities to file data on the original cost of their operating plants and equipment.

Last week the Federal Power Commission, in ordering rate reductions by three Western natural gas companies, reported that it had used the "prudent investment" method and allowed to each company a rate of return of 6½ percent.

•

## Construction Profits Are Termed "Write-Ups" by FPC

In a precedent-setting opinion, the Federal Power Commission this week declared that construction profits in affiliated company transactions — which create an excess of corporate cost of plant over original cost—are "write-ups" and must be so disposed of under the FPC uniform system of accounts.

The opinion was contained in an order requiring the St. Croix Falls Minnesota Improvement Co. to establish $53,520 in its electric plant adjustments account by charges to earned surplus. The St. Croix Falls Wisconsin Improvement Co. was ordered to take similar action with regard to $27,951.

## Utility Reports

| | Net Income 1942 | 1941 |
|---|---|---|
| †American Gas & Electric | $13,832,314 | $15,231,999 |
| †California Electric Pwr. and sub | 730,945 | 546,352 |
| *Commonwealth & Southern and subs | 11,968,039 | 12,487,096 |
| *§Public Service of N. J. and subs | 20,188,526 | 23,416,511 |
| | 1941 | 1940 |
| ‡Boston Edison | 6,006,126 | 5,900,140 |
| ‡LaClede Power & Light | 262,892 | 248,047 |
| ‡Niagara Hudson Power | 8,712,370 | 8,719,126 |
| ‡Northern Indiana Pub. Serv. | 2,767,656 | 2,926,239 |
| ‡Pennsylvania Power | 844,853 | 849,217 |
| ‡Public Service of Indiana | 3,159,636 | 2,749,019 |
| ‡Puget Sound Power & Light | 2,596,597 | 1,924,380 |
| ‡South Carolina Power | 438,829 | 409,087 |

* Twelve months ended February 28.
† Twelve months ended January 31.
‡ Twelve months ended December 31.
§ Corrected report.

# PRIORITIES AND PRICE SHORTS

DETAILED PLANT-BY-PLANT CHECKUP on priorities compliance by 90 primary processors of copper has been completed and is to be followed at once by a similar checkup on the books of three branches of the same industry—scrap dealers, foundries, secondary melters. Inspectors borrowed from Federal Trade Commission, Interior Department, and the Wage-Hour Division do this work under Hector J. Down, ex-chief of the SEC's account-investigator staff.

A SPECIAL SECTION to cut red tape in getting large quantities of mired scrap is getting under way in the Bureau of Industrial Conservation. Only jobs this outfit is looking for are those where scrap metal is tied up by financial, legal or other special reasons such as uncertain ownership, clouded titles, high cost of demolition, remote location, etc. J. Widman Bertch, ex-Detroit advertising man, heads up the assignment.

ALMOST BEFORE THE INK WAS DRY on the order limiting deliveries of gasoline at the service station level on the two coasts, additional tanker sinkings formed a switch in plans. It'll be rationing to the ultimate consumer by coupon books, just as with sugar, as soon as the paper work can be done. Question at the moment is whether rationing will be only in coastal states or nationwide.

AN AMENDMENT to the rubber conservation order this week by the WPB (also see page 73 this issue) declared that rubber could not be used for cable splicing compounds except on special approval of the rubber branch, prohibited the use of crude rubber for switchboard mats and matting, reduced the amount of rubber for insulated tools, but permitted increased amounts of crude rubber for molded cable connectors and terminal blocks.

THERE'LL BE FEWER new signs as a result of Order L-29. It provides that use of iron and steel in signs of 36 square inches or more shall be restricted to 50 percent of 1940 for the next three months and, after July 1, ended entirely. Signs with less than 5 percent of their total weight in metal are exempt.

PLANTS MANUFACTURING electrical insulating papers needed for many war purposes are facing complete shutdowns because of a shortage of the manila rope scrap upon which such plants depend for raw materials, the War Production Board announced this week.

# HOW

## DESIGN . . . CONSTRUCT OPERATE MAINTAIN

### Lighting

## Blackout Lighting Improvisations

Fluorescent signs and materials can be adequately activated by a 250-watt filament-type lamp, designated as "blacklight purple-X" lamp, which operates directly on 110 volts, 60 cycles without auxiliaries. Since the lamp operates at a very high temperature it is not recommended for use near inflammable or scorchable materials. Life is said to be 50 hours on an intermittent basis. Bulb is A-21, bases medium.

Stove black or other dead black paint applied directly to the bulb is effective in shading switchboard and instrument lamps that must be operated during blackouts. By applying paint to different parts of the lamp surface, as indicated, shape and size of illuminated area can be controlled.

For lighting instrument board, vital signs, indoor maps and the like during blackout a satisfactory fixture may be made from plywood. The fixture (shown) is a box 10 in. high, 8 in. wide and 8 in. deep, inclosing a 25-watt lamp. Light emerges from a $\frac{3}{4}$ x 6-in. slot which is covered on the inside with a diffusing plastic.

**BLACKOUT lighting ideas recently displayed by Chicago Lighting Institute**

(1) Black light purple-X filament lamps for activating fluorescent materials operates directly on 110 volts, (2) paint-shaded lamps for switch and instrument boards, (3) slotted blackout fixture for lighting wall maps, signs, etc.

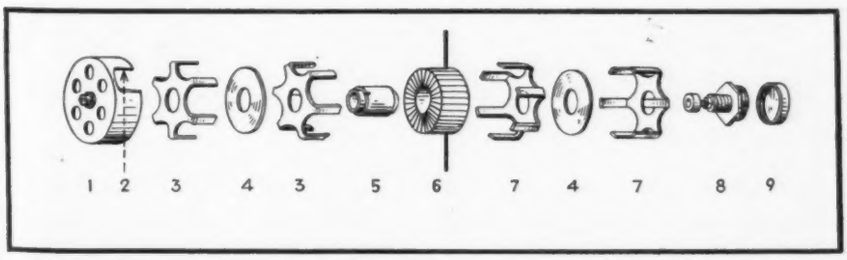
### New Development

## Timing Motor Uses Hysteresis Principle

A form of self-starting synchronous timing motor has been designed by the Westinghouse Meter Division, Newark, N. J., which combines the features of the hysteresis principle with the advantage of a slow running speed. It is designed particularly for use in demand meters, two-rate meters, recording instruments and time switches.

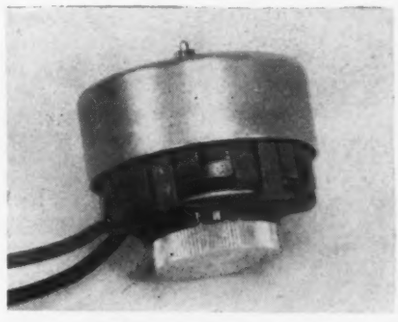
In this form of motor, referring to the "exploded" view, the operating coil (6) magnetizes the cylindrical core (5), which is assembled to four pole-piece punchings (3) and (7). These pole-piece punchings each have six polar projections, which when assembled with the core, surround the coil with a system of 24 cylindrically arranged poles.

There are two sets of paired six-pole punchings. In each set the pairs are separated by a copper washer (4) and (4), which acts as a phase splitter, causing alternate poles to lag behind the others and resulting in an




**EXPLODED view of synchronous clock motor**

1—Aluminum spider and rotor. 2—Hardened steel rotor ring. 3—Upper pole piece pair. 4—Copper phase splitting washer. 5—Cylindrical iron core. 6—Operating coil. 7—Lower pole piece pair. 8—Lower bearing. 9—Grease retaining cup.



**TIMING MOTOR arranged for open gearing drive**

elliptical rotating field derived from the single-phase coil winding.

As the two sets of pole-pieces are attached to opposite ends of the central magnetic core, their phase angle is opposed or 180 deg. displaced from that of the pole-pieces at the opposite end.

This results in a twelve-pole magnetic field, really six poles each "split" with one-half lagged approximately 45 deg., giving a synchronous rotor speed equal to ten revolutions per second when a 60-cycle source is applied.

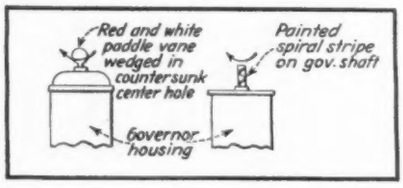
This rotating field enters a hardened steel rotor ring (2), which is supported inside the periphery of an aluminum spider (1). The starting energy is transferred across the air gap and functions as a torque due to the hysteresis loss in the steel ring (2). When the speed reaches synchronism the hysteresis on the rotor disappears and the running or synchronous torque is due to the remanent magnetization of the steel ring, which retains twelve "permanently" magnetized polar zones corresponding to the twelve pole-pieces.

These poles lag at a slight mechanical angle behind the rotating magnetic field-poles, resulting in the magnetic attraction which produces the necessary running torque. Similarly as in the case of any other synchronous motor, this angle increases with the load until it exceeds a critical value, after which the motor gets out of step or perhaps stops altogether.

Entire rotor, consisting of steel rotor ring (2), aluminum cup (1), and shaft, weighs only 5½ grams.

## Steam Plant

### Flag Indicator Shows Turbine Start




A tiny wooden paddle vane, red on one side, white on the other, wedged in the countersunk center hole in the end of the turbine governor shaft is is used by turbine operators at the Omaha plant of the Nebraska Power Company as a starting indicator. By watching the paddle—the only clearly visible moving part of the turbine—operators can tell when the machine first begins to turn over on starting. At extremely low starting speeds ordinary revolution indicators will not register. Alternate scheme, also used in this plant, is a painted spiral on an extension of the governor shaft.

## Pole Lines

### Support H-Frames on Bridge Bents

Construction engineers of Dallas Power & Light Company resorted to "bridge bent" construction recently to support the poles of six H-frame structures that carry a new 60-kv. transmission circuit across Mt. Creek Lake. Accompanying illustrations show how the structure was built.

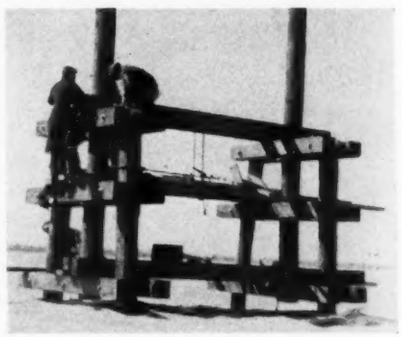
Depth of Mt. Creek Lake, which at the point of crossing is 2 to 6 ft., complicated the problem of erecting the structures. The depth was considered too great to allow poles to be sharpened and set in the lake bottom and held by guys. On the other hand, the water was not deep enough to float heavy pile-driving equipment. Light pile-driving equipment, however, was finally improvised. Floated on a shallow draft barge, it proved satisfactory for the work.

As the illustrations show, individual poles were supported by "bridge bents" made by driving 35-ft. piling to a penetration of 20 ft. on each side of the pole and joining them with 10 x 10-in. cross-members, as indicated. The piling structures at both poles of an H-frame were connected by 6 x 10-in. wooden members. All piling and timber used in the structures were creosoted—all hardware galvanized.

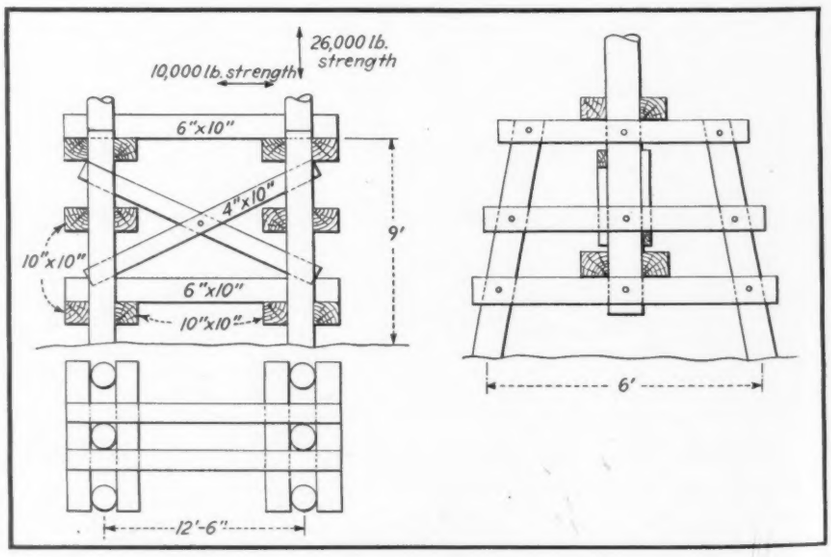
Strength of the pole-supporting structure in both uplift and compression is estimated at 26,000 lb., while its transverse strength at right angles to the line is 10,000 lb., or more than the strength of the poles.

The transmission structures were assembled completely on the shore of the lake and floated to location, where they were erected by the crane on the pile driver. Poles were 55 ft. long and were set on 12 ft. 6-in. centers.

In raising the assembled structure with the crane a yoke was attached



**SIX braced H-frame structures supported on novel piling structure carry 60-kv. transmission circuit across shallow Texas lake**




**DETAILS of piling structure used to support wood-pole transmission structure**

to the tackle block, which when chained between the poles acted as a spreader, relieving X-braces from stress. With the spreader attached just below the braces, so that the structure was slightly butt-heavy, the structure was raised with ease.

## Pole Lines

### Aerial Mapping Cuts Survey Cost in Two

Aerial survey technique resulted in quick, easy selection of the best route for Wisconsin Public Service Corporation's new Green Bay-Manitowoc 66-kv. transmission line in 1940. The aerial survey method also allowed a more favorable opportunity to purchase right-of-way. Use of a plane table for plotting topography in the field—in conjunction with the aerial map—improved the accuracy of the survey and considerably reduced work required to the end that cost of the complete survey was about half of the cost according to methods previously used.

In arriving at the final route for the line aerial photographs were secured of the general route, previously selected. These were pieced together into a mosaic map and the exact route selected after examination, advantage being taken of the opportunity to miss obstructions such as woods, buildings and swamps.

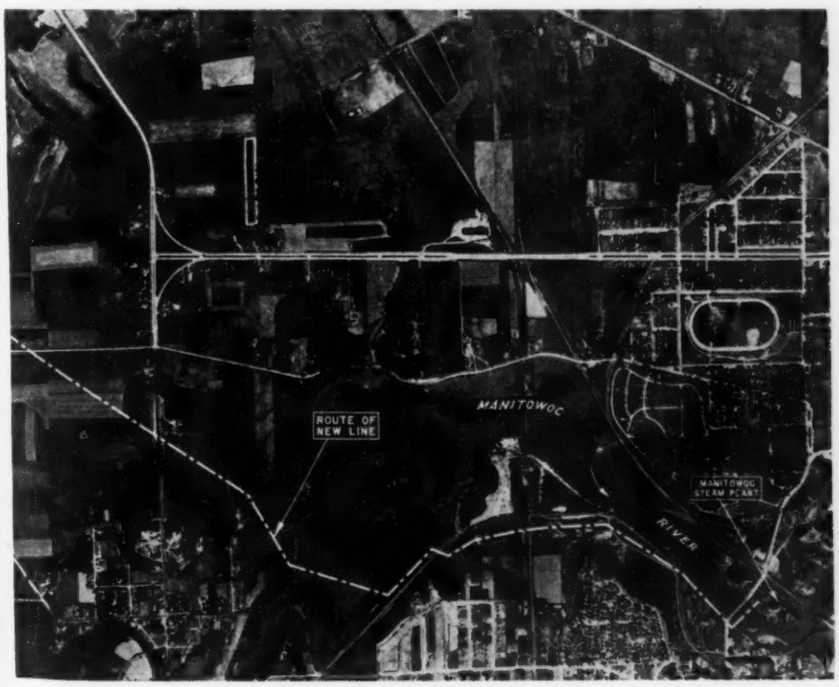
Route so selected was checked and located in the field by tying markers to fences where the route crossed highways. This preliminary location was made by scaling the aerial map and making measurements in the field from observable objects. This marked route was so close to the final survey route that in very few places did the difference in location amount to more than a few feet and often the two coincided.

By marking the route in this way before actually making the survey it was possible to option the right-of-way before making the survey. A schedule of unit prices for right-of-way was worked out for the different kinds of land and number of structures. On this basis it was possible to option the right-of-way quite satisfactorily.

After optioning was under way, a survey crew was sent into the field. First the center line was run. This was relatively quick and easy as compared to other methods because it was practically unnecessary to run random lines due to the use of the aerial mosaic. Also, no trouble with property owners was encountered since they had previously been approached by the right-of-way crews.

After the center line was run profile and topography of the route were obtained. The plan and profile were drawn up in the office and used to span the line. In this instance a departure from usual methods was also made, in that a plane table was used in the field to plot the topography. The plane table was fitted with a drafting machine enabling the engineer to plot the terrain directly in the field without the use of notes.

This cut the cost considerably since work was done in the field with fewer men and greater accuracy, discrepancies being checked on the spot before the surveying set-up was changed. It also eliminated time spent in the office reducing the notes and materially expedited the drawing of the plans and profiles.



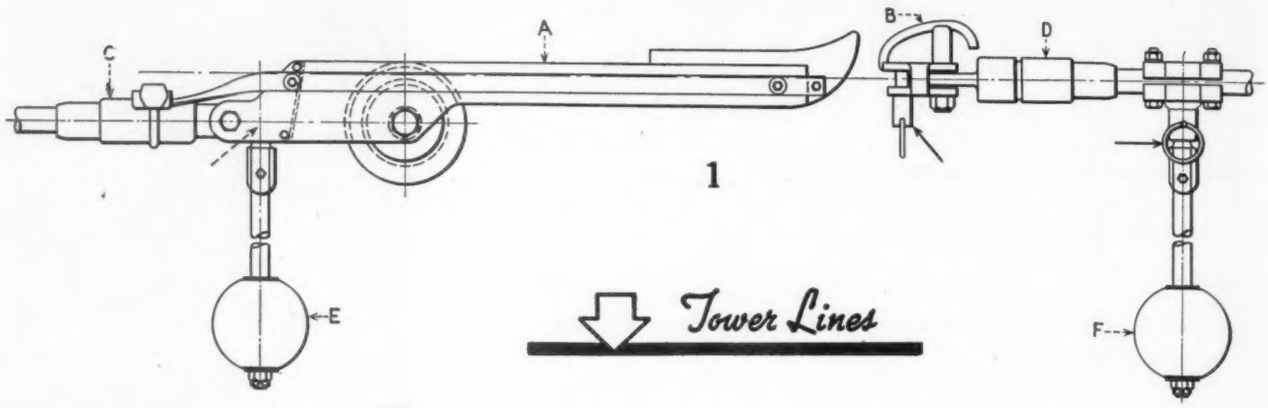

AERIAL MAP section Green Bay-Manitowoc line survey

## Industrial Power

### Old Motor Acts as Flywheel

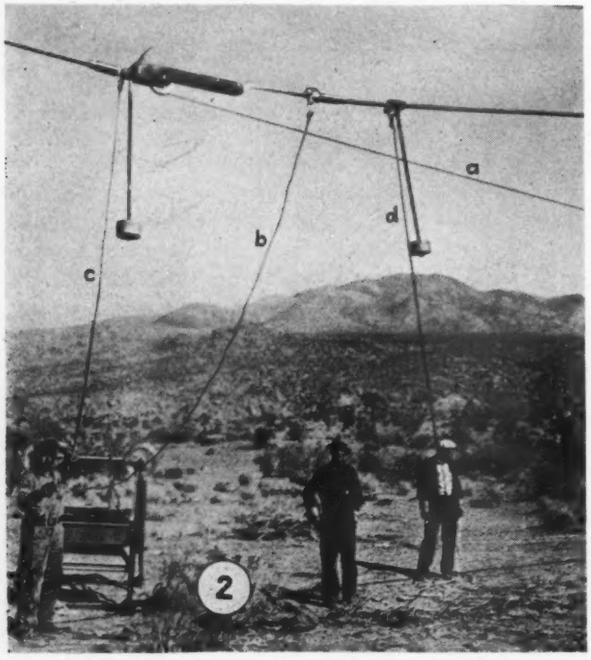
The d.c. motor that used to drive this band saw in the ivory department of the Brunswick-Balke-Collender Company, Muskegon, Mich., plant now serves as a stabilizing flywheel, permitting the saw to be driven by an a.c. motor of half the previous horsepower. Stripped of its copper following a changeover, the rotor of the 1½-hp. 750-r.p.m. d.c. motor stores enough kinetic energy to permit the band saw now to be driven successfully by a ¾-hp., 900-r.p.m. a.c. motor.

# FIELD SPLICE ON 287-KV. LINE




1

Tower Lines



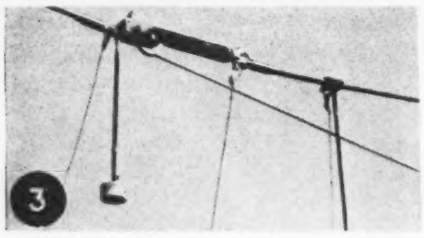

2

By EVERETT J. BOWE
Junior Mechanical Engineer, Design and Construction Division, Los Angeles Bureau of Power and Light

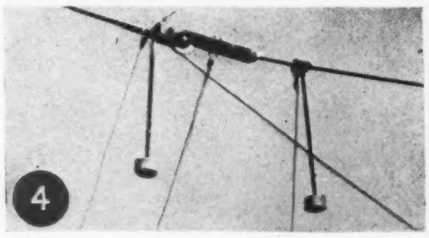
By the development and fabrication of an automatic splicing equipment engineers of the Los Angeles Bureau of Power and Light have provided for quick emergency repairs in case of a break in the 1.4-in. diameter, 10-segment, hollow-core conductor of the 287-kv. Boulder Dam transmission line. Repairs in isolated section of desert may be made by two men and a winch, allowing the line to be restored to service, in approximately two hours. In mountain terrain correspondingly longer time will be required.

During repair operations communication with the load dispatcher is carried on over the carrier circuits by means of the patrolmen's receiving sets in their patrol cars and gasoline-engine powered carrier-sending stations spaced every 30 miles along the lines.

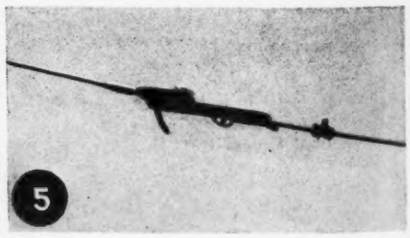
H. C. Gardett is chief electrical engineer and general manager of the Bureau of Power and Light, with Ray Martindale as assistant chief electrical engineer and general manager in charge of operations; C. C. Ruble, superintendent of operations, and J. A. Joyce, chief transmission line patrolman.



3



4



5

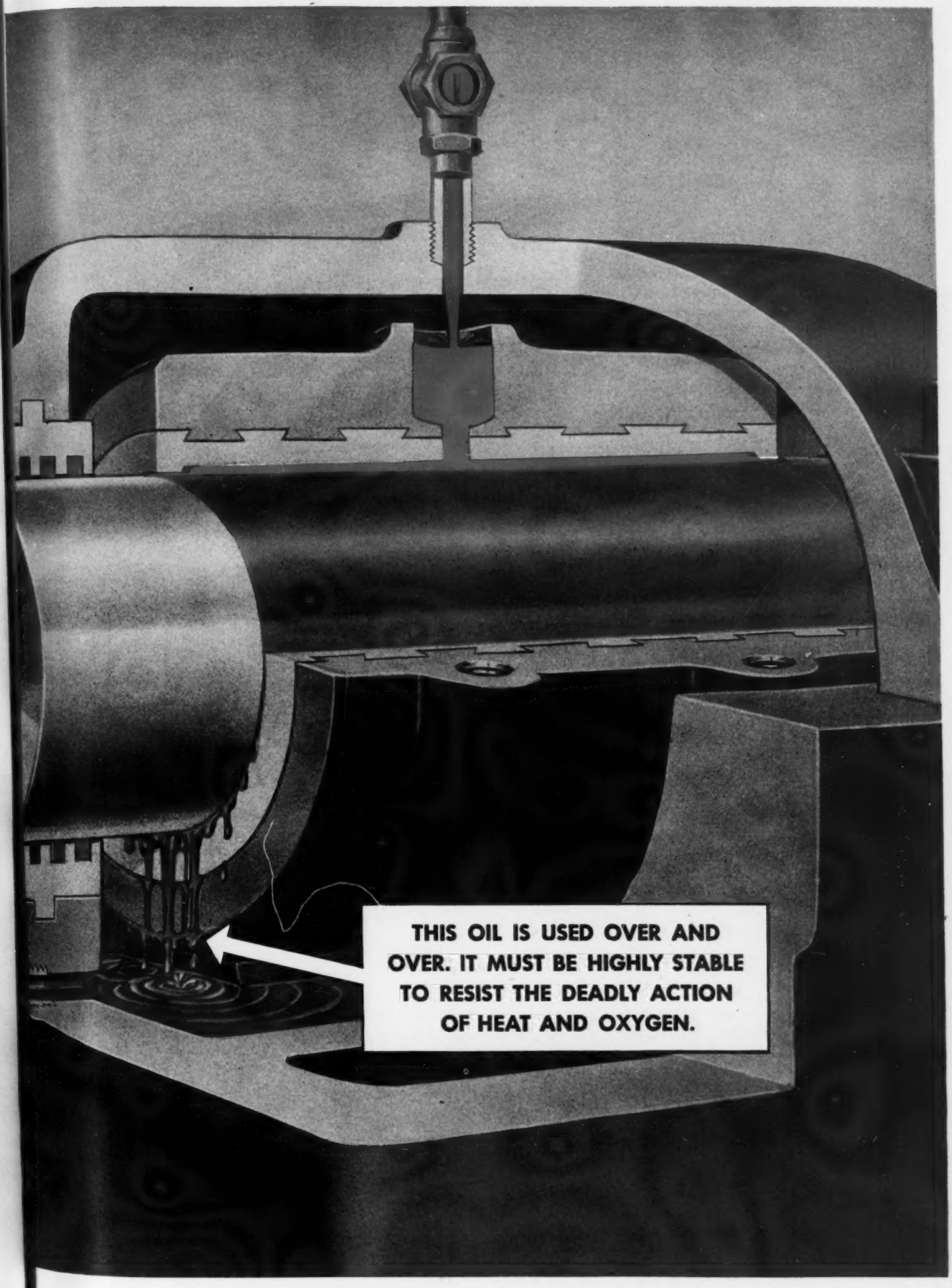
**1** Automatic splice consists of two principal elements, A and B, for fastening to ends of the broken conductor by standard dead-end hollow-conductor splices, C and D. To each end of the hollow conductor there is attached a detachable torque arm, E or F, to prevent twisting when strain is applied. Weight of the automatic splice is approximately 35 lb. and of each torque arm, including balance weight, is approximately 40 lb. Arrows indicate location of spring-loaded pins for detaching strain line and torque arms.

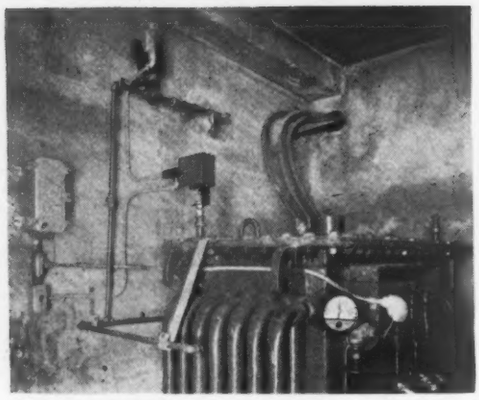
**2** Method of joining broken cable with automatic splicing equipment — After the splice parts are attached to the conductor ends, a wire rope strain line (a) is threaded through the sheave in the connector (part A) and fastened to the rider (part B) on the other broken conductor end. Power is applied to the strain line by means of a truck-mounted winch. When the conductor clears the ground, hand line (b) is tied to strain line release and (c) and (d) to each torque arm release.

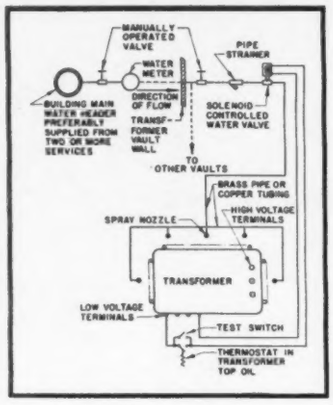
**3** Rider enters the connector after sufficient strain has been applied to the line by the winch.

**4** Automatic splice is engaged and tension is relieved on the strain line.

**5** Temporary splice is completed. From the ground the strain line is disconnected by a spring-loaded pin; similarly the torque arms are released.


THIS OIL IS USED OVER AND OVER. IT MUST BE HIGHLY STABLE TO RESIST THE DEADLY ACTION OF HEAT AND OXYGEN.






**WATER SPRAY system, adapted to installed units in underground transformer vault, reduces transformer operating temperatures and thus permits substantial increase in permissible transformer loading**

**Comparative Ratings for a 500-Kva. Transformer With and Without Water Spray Cooling**

| Transformer Loading | Hot Spot Copper Temperature Limit in Deg. C. | Allowable Load—in Kva. | | Approximate Increase in Rating Effected by Use of Water Spray in Percent |
|---|---|---|---|---|
| | | Natural Ventilation Only | Natural Ventilation Plus Water Spray | |
| Continuous | 95 | 460 | 590 | 28 |
| | 110 | 540 | 655 | 21 |
| | 125 | 605 | 715 | 18 |
| Cyclic | 105 | 600 | 675 | 13 |
| | 110 | 630 | 700 | 11 |
| | 125 | 715 | 785 | 10 |

*New Development*

## Water Spray System Cools Transformers

A water spray system developed by Consolidated Edison Company of New York engineers reduces transformer operating temperatures and so permits a substantial increase in transformer rating over that obtainable with natural ventilation only. The water spray breaks up the heated film of air surrounding the transformer tubes and also cools the air by the evaporation of moisture.

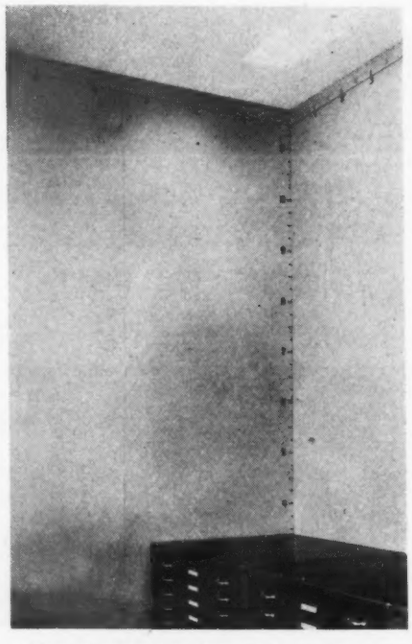
This system has been adapted to existing transformer vault installations in two local department stores. Each transformer is equipped with five nozzles. A thermostat, set in the transformer oil, automatically turns on the water spray when the oil reaches 70 deg. C. In operation, system uses 7½ gal. of water an hour.

Comparative ratings for a 500-kva. transformer with and without water spray, assuming an outdoor relative humidity of approximately 60 percent and an outdoor air temperature of 26 deg. C., are given in the accompanying table, reprinted through the courtesy of Allis-Chalmers *Electrical Review*. In this table, which incorporate Consolidated Edison test results, the indicated loading limits are for distribution transformers supplying a low-voltage network. The 95 and 105 deg. C. hot-spot temperature limits are used for normal loading, which may be repeated daily with all high-voltage feeders supplying the network in service, and are the limits proposed by the American Standards Association. First contingency loading with a hot-spot temperature of 110 deg. C. is permitted at times when one high-tension feeder is out of service. Second contingency loading, with a hot-spot temperature of 125 deg. C., is permitted for one eight-hour peak-load period with two associated feeders out of service. Continuous loading was at 500 kva.; cyclic loading consisted of an overnight sixteen-hour period at 225 kva. load, followed by eight hours—8 a.m. to 4 p.m.—at 750 kva. load.

*Industrial Power*

## Layout Measurements Visualized on Walls

Heald Machine Company's plant engineering department at Worcester, Mass., aids layout work of all sorts by providing draftsmen with permanent full-sized scales in feet and fractions drawn along the upper walls and vertically in corners of rooms devoted to equipment installation planning. Such a perspective is useful in laying out lighting units, locating power-driven machinery on drawings, or providing space for many other items of equipment and material. The scheme aids the transition between scale drawings and actual dimensions in the field necessary to enable the designer and layout man to make best use of available space.



**LAYOUT WORK facilitated by scales on walls and ceiling**

*Hydro Plant*

## Oversize Bus for 108,000-Kw. Generators

In handling the output of the 108,000-kw. Grand Coulee generators, it was necessary to design a bus structure of record size which involves several special features. One of these, as shown in the accompanying illustration, was a tubular copper housing 30 in. in diameter.

The generator-voltage bus structure, three sets of which were furnished by I-T-E, is rated at 5,000 amp., 60 cycles and is provided with potential transformers, current transformers, generator-protective lightning arresters and capacitors. The buses operate at 13,800 volts. The phases are separate.

Bus structures consist of copper buses, rigid square tubular copper, about 5 in. on a side, completely

# HOOSIER SERVICE

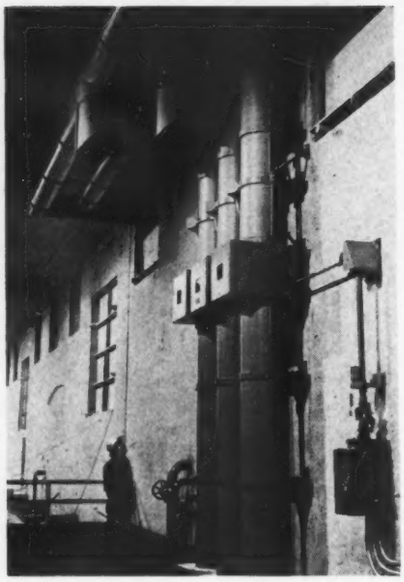
## *is keeping in step*

**Behind each soldier and war weapon lies unprecedented industrial activity and expansion. Keeping in step with this new, speeded order, HOOSIER has shaped its facilities to fill utilities' new transmission line erection and revision needs. *With established efficiency, as always, HOOSIER serves!* Take transmission line erection problems to HOOSIER! !**

**HOOSIER ENGINEERING COMPANY**

CHICAGO — 46 SO. FIFTH ST., COLUMBUS, OHIO — NEW YORK

ERECTORS OF TRANSMISSION LINES



**THIS record size bus is required to handle energy from the 108,000-kw. Grand Coulee generators to the transformer bank. It is rated 5,000 amp., 13.8 kv. The 30-in. diameter sheet copper tubes inclose the 5-in. rigid copper bus. The square boxes house the gang-operated disconnects**

metal-inclosed and fully air-insulated, with each phase mounted on porcelain insulators in a separate metal-inclosed compartment. It is designed to withstand, with a factor of safety of not less than two, the mechanical and electrical forces induced by current having an initial, fully offset, root-mean-square value of 100,000 amp. (initial, fully offset, peak value of 163,000 amp.) flowing in phase in any two bus conductors, or a similar three-phase short circuit of 120,000 amp., whichever will furnish the greater stresses. The conductors are mounted on four radial insulators inside each of the metal rings that support the buses and their housings. The housings are $\frac{1}{8}$-in. sheet copper, 30 in. in diameter.

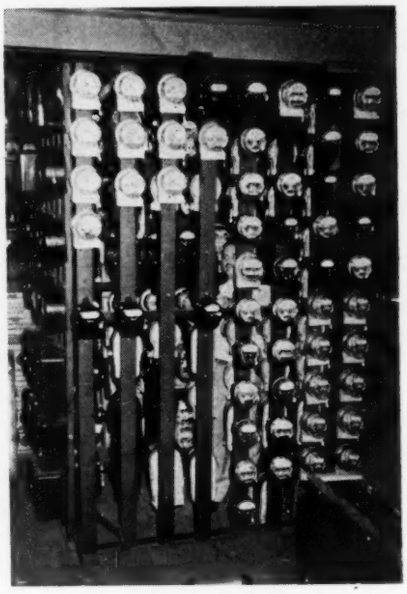
The fully assembled structures, including the taps to the potential transformers and generator-protective apparatus themselves, are capable of withstanding dielectric tests at 60 cycles of not less than 54,000 volts, in accordance with A.I.E.E. standards. The normal rated continuous current-carrying capacity is not less than 5,000 amp. per phase at 60 cycles.

Disconnecting switches are installed in each bus in special housings. The switches, one in each phase, are gang-operated by a motor in a separate compartment on the wall. They are triple-pole, single-throw, with high-pressure, self-adjusting, silver-plated contacts. The switches are rated at not less than 5,000 amp. continuous carrying capacity. Each housing has three safety-glass windows so located that the switch contacts may be easily inspected.

The branches at the ceiling of the gallery shown are the delta bases for the transformer bank, located on the deck on the other side of the concrete wall. Incidentally, the steel I-beams supporting the floor grating of this gallery, situated adjacent to the buses, are encircled by heavy copper straps to prevent heating from magnetic induction.

## U-Shaped Meter Rack Saves Floor Space

*Meters*

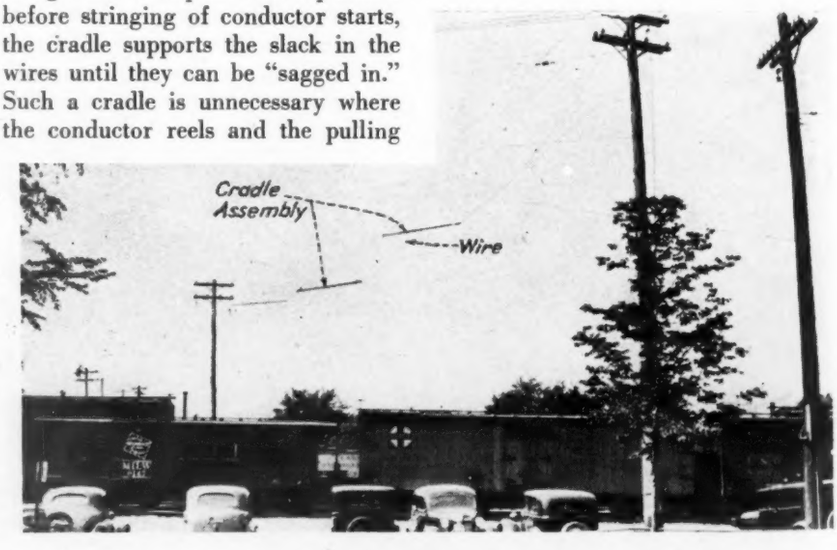


Valuable floor space has been saved at Central Illinois Electric & Gas Company meter shop, Rockford, Ill., with this U-shaped meter rack, 5 ft. long, 4 ft. wide and 9 ft. high. Conventional practice is to hang meters on a straight line rack; however, at Rockford necessity for space economy led metermen to adopt the rack shown. Tested meters are hung on the three outer faces of the U as well as on the three inside faces. Wooden 2 x 4-in. uprights from which meters are hung are bolted on 9-in. centers to an angle-iron frame.

## Cradle Keeps Wire Clear of RR Tracks

*Pole Lines*

To keep distribution and transmission conductors clear of railroad tracks and highways during stringing operations one midwestern utility uses the illustrated cradles of rope and crossbars suspended between the crossing structures. Assembled on the ground and pulled into position before stringing of conductor starts, the cradle supports the slack in the wires until they can be "sagged in." Such a cradle is unnecessary where the conductor reels and the pulling winch can keep a constant stringing tension. However, where only an improvised bar or timber brake bearing on the pay-off reel is used some such scheme as illustrated is almost essential.



# For Severe Conditions

## PERMANENTLY INSULATED ROCKBESTOS

One hundred and twenty-two different standard types of *permanently insulated* wire have been developed by Rockbestos—all designed to give better and longer service *under severe operating conditions* in specific applications. They are built to *permanently resist* such wire-destroying hazards as heat and moisture, oil, grease, corrosive fumes and fire. This page shows a few that are widely used in industry. For further information send for our catalog.

**RESISTS**
Heat—Fire
Corrosive Fumes
Oil—Grease
Moisture

**600 VOLT A.V.C. SWITCHBOARD WIRE—TABLE B**

(Underwriters' Type AVB)

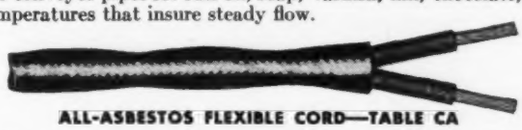
*Sizes No. 18 to 4/0 A. W. G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.*

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A. V. C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

**INDUSTRIAL HEATING CABLE—TABLE LH**

*No. 19 A. W. G. nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.*

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.



**ALL-ASBESTOS FLEXIBLE CORD—TABLE CA**

*Sizes No. 10 to 18 A.W.G. with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A.V.C. (asbestos and varnished cambric) constructions.*

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blueprint machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

**600 VOLT A.V.C. BOILER ROOM WIRE—TABLE C**

(Underwriters' Type AVA)

*Sizes No. 18 to 4/0 A. W. G. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.*

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A. V. C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

**ASBESTOS INSULATED MAGNET WIRE**

*Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.*

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of A. V. C. Motor Lead Cable will complete the failure-proofing.

**THERMOSTAT CONTROL WIRE—TABLE TC**

*Sizes No. 14, 16 and 18 A. W. G. in two to six conductors with 12¾, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.*

A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its lifetime insulation and rugged steel armor will give you troubleproof circuits.

**600 VOLT ALL-ASBESTOS RHEOSTAT CABLE—TABLE R**

(Underwriters' Type AI)

*Sizes No. 18 A. W. G. to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.*

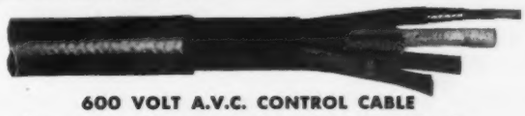
Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.

**600 VOLT A.V.C. MOTOR LEAD CABLE—TABLE L**

(Underwriters' Type AVA)

*Sizes No. 18 A. W. G. to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.*

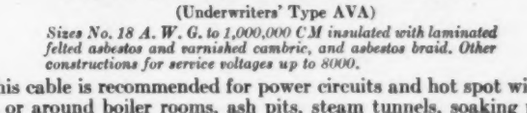
Heatproof, fireproof, greaseproof and oilproof, this cable will not dry out and crack, won't burn or carry flame, and will remain permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, boiler rooms, etc.



**600 VOLT A.V.C. CONTROL CABLE**

*In one to 19 conductors. Standard stranding A. W. G. No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.*

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.



**600 VOLT A.V.C. POWER CABLE—TABLE E**

(Underwriters' Type AVA)

*Sizes No. 18 A. W. G. to 1,000,000 CM insulated with laminated felted asbestos and varnished cambric, and asbestos braid. Other constructions for service voltages up to 8000.*

This cable is recommended for power circuits and hot spot wiring in or around boiler rooms, ash pits, steam tunnels, soaking pits, tenter frames, glass plants, steel mills, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures indefinitely.

**ROCKBESTOS PRODUCTS CORP.**
*842 Nicoll Street, New Haven, Conn.*

**122 STANDARD TYPES**

# ROCKBESTOS

***The Wire with Permanent Insulation***

By F. M. STARR
General Electric Company

Line Engineering

# RULES
# for Parallel Operation of Voltage Regulators

TABLE OPERATION of paralleled regulators means not going to full buck or full boost as a result of circulating currents following a tap change.

Three of six General Electric standard-practice schemes (A, B, C) are founded on the stability principle that the control of each regulating equipment is so adjusted that the reaction of any circulating current on it will call for a change in voltage which will correct for the circulating current. Each regulator has its own voltmeter, compensation, etc. Three others (D, E, F) have controls of separate units so interconnected that they are required always to occupy the same voltage position except during voltage changing transition, when a difference of one increment voltage may exist temporarily.

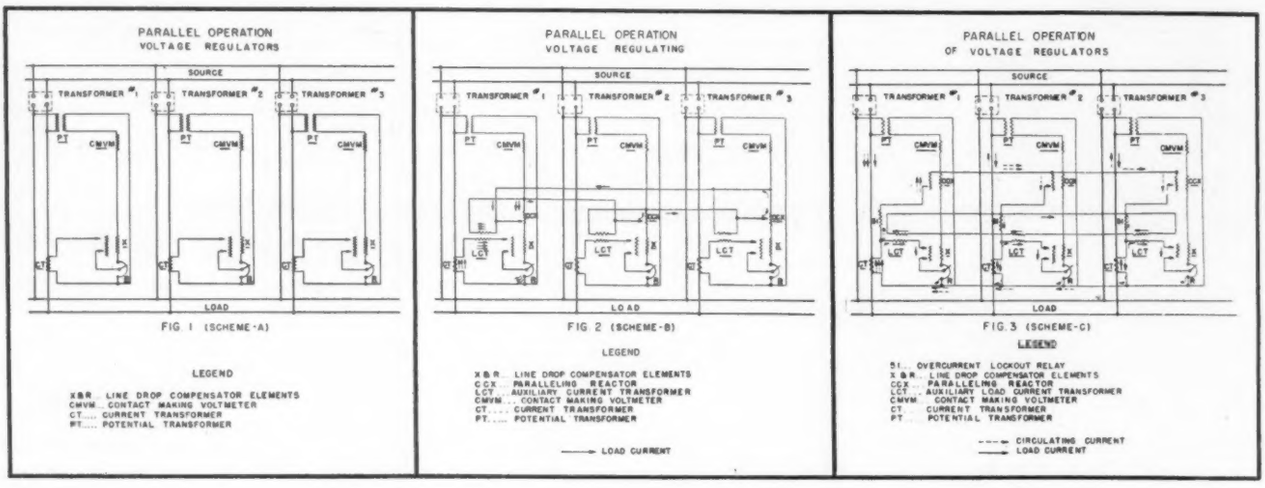



FIG. 1 (SCHEME-A)

FIG. 2 (SCHEME-B)

FIG. 3 (SCHEME-C)

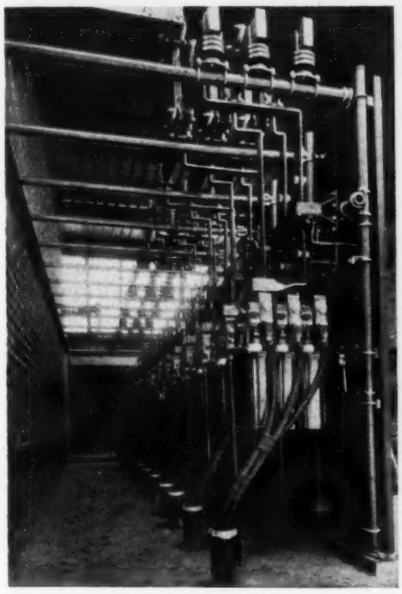
## Comparison of Six Schemes for Parallel Operation of Voltage Regulators

| SCHEME A | SCHEME B | SCHEME C | SCHEME D | SCHEME E | SCHEME F |
|---|---|---|---|---|---|
| Group 1<br>In the three schemes of this group, each unit is equipped with its own automatic control - i.e., voltmeter and compensator - and stability is obtained by voltmeter and compensator adjustments.<br>Use one of this group if the feature of convertibility to independent automatic operation for each unit is desired.<br>Also use one of this group if it is desired that the automatic control correct for all circulating currents regardless of the cause. | | | Group 2<br>In the three schemes of this group, only one automatic control - i.e., voltmeter and compensator - is provided for all of the units operating in parallel. Stability is obtained by interlocking the physical positions of the regulators.<br>Use one of this group if convertibility to independent automatic operation is not considered necessary, and if circulating currents are not considered serious enough to warrant provision for their correction. This group corrects only for those circulating currents resulting from differences in regulator positions. | | |
| Use scheme A where units in parallel are physically apart as in Primary and Secondary Networks. | These five schemes all require electrical (or mechanical) interconnections between units, and are not applicable if units are physically apart. | | | | |
| Requires no electrical interconnections between units. | Requires 2 electrical interconnections between units. | Requires 3 electrical interconnections between units. | Requires 5 or more electrical interconnections between units. | Requires 5 or more electrical interconnections between units. | No electrical interconnections. |
| Each unit has a line drop compensator.<br>Stability is obtained by reducing or reversing reactance compensation.<br>Voltage regulation is obtained by increasing resistance compensation. | Each unit has a line drop compensator for voltage regulation and a paralleling reactor for stability.<br>A low-voltage, one-to-one ratio current transformer is required.<br>Compensators of different units may be adjusted independently.<br>Range of compensator adjustment may be restricted.<br>Lockout feature as safeguard against excessive circulating current is easily obtained. | Each unit has a line drop compensator for voltage regulation and a paralleling reactor (much smaller than in scheme B) for stability.<br>A low-voltage, one-to-one current transformer is required.<br>Compensators may be adjusted independently. Range of compensation is unrestricted.<br>Lockout feature as safeguard against excessive circulating current is easily obtained. | One master control energizes all units simultaneously.<br>Note:-<br>1. Cannot be used with induction regulators.<br>2. Cannot be used on spring-driven mechanisms. | One master control energizes master unit which in turn energizes the other units by means of:<br>1. Dial switches on the mechanisms with step regulators.<br>2. Selsyn motor control with induction regulators.<br>Use this scheme instead of D if load-ratio-control or step regulator mechanisms are spring driven. | All units are mechanically shafted together and operated by one master control and prime mover.<br>This scheme is seldom used, as mechanical coupling is difficult to arrange. |

## Industrial Power

### Switchboard Features Accessibility

Vital power circuits radiating from a main control section in an Eastern industrial plant engaged in manufacturing war material were laid out to insure liberal space behind the switchboard under all conditions of operation and maintenance.



**LIBERAL SPACE** for operation and maintenance is provided at rear of this war production switchboard

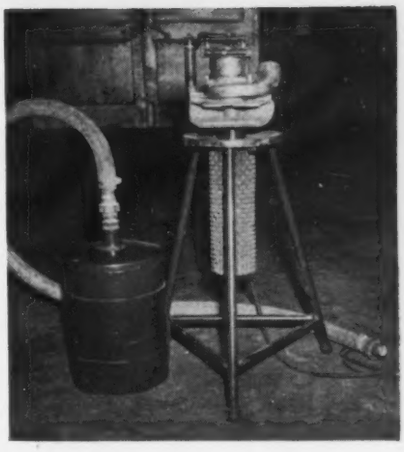
Protection of 440-volt feeders against fire was borne in mind in the use of pipe framing for panel and bus supports, with flexibility insured through clamping rings as shown. Short and direct copper bar connections were made from the power buses above to the oil circuit breakers controlling the several feeders, and diagonal runs of cable to conduit risers carried about 12 in. above the concrete floor saved material and also provided room behind the panels for inspection and cleaning, with ease in lowering the circuit breaker tanks.

It was planned in this layout to provide space enough to enable any interruption to be minimized, and further to protect the switching equipment by fireproof walls, with a large window space at the far end. With the spacing arrangements shown, each circuit is so well clarified that there appears to be no likelihood of errors in repair work, and it was not deemed necessary to isolate the breakers at 440 volts in separate compartments.

## Substations

### Dry Transformers With Simple Blower

Common method of drying substation transformers that have been in dead reserve long enough to have absorbed moisture is to excite the transformer and blow air through the gas space above the transil oil. For this purpose Oklahoma Gas & Electric Company uses a home-made blower that is sufficiently weatherproof to be left in unattended operation for the three to six weeks drying period usually required.



**CURRENT** transformer case houses vacuum cleaner fan and motor used in drying spare substation transformers

This blower, an improvement over the usual makeshift canvas duct, was assembled from spare parts. Principal elements are a conventional 110-volt household vacuum cleaner motor and fan housed in a current transformer case. A standard gasoline pump hose and cylindrical bug screen over the fan inlet complete the device.

## Lighting

### Old Loop Controls New Multiple System

By P. A. BURVANT
Assistant in Charge Street Lighting
New Orleans Public Service, Inc.

In changing from series to multiple street lighting New Orleans Public Service, Inc., found it profitable and advantageous to utilize some of the old series conductors as a pilot or control wire for the relays on the new system. These wires are supplied with 120 volts power from the substation during the daytime to energize the relays and hold the circuit to the lights open. At night time the pilot wire circuit is opened, deenergizing the relay coils and letting relay contacts drop closed.

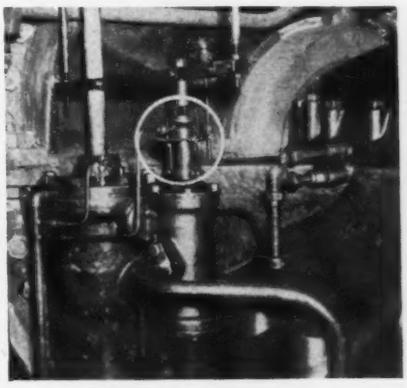
This produces a system of minimum outages. Defective relays or control wires do not interrupt lighting service at night, and in the daytime failures are detected when lamps burn after the control wire has been energized.

Cascading at about the midpoint of the pilot wire insures satsifactory operating voltage at the farthest lamp and protects against losses by contacting with higher voltage lines. In

## Steam Plant

### Light Friction Damps Governor Pilot Valve

The simple friction damping attachment shown has been installed on the shaft of a turbine governor pilot valve at the Omaha plant of the Nebraska Power Company to eliminate high-frequency fluctuations of the valve. Formerly, when sudden turbine load changes were made, there was a tendency for the pilot valve to "surge," causing the machine to hunt slightly. This condition was eliminated by placing felt-lined jaws



under light spring tension around the pilot valve stem. Resulting slight friction—which can be adjusted—was sufficient to damp out the fluctuations.

such cases damage is restricted to the half of the circuit in which the fault occurred.

## Truck Equipment

### Innovations Feature Northwestern Truck

Feature of the new line truck of Northwestern Electric Company, Portland, Ore., designed by F. S. Beach, company engineer, is the gin pole rig in which the shaft supporting brackets are inclined inward toward the center line of the body, permitting a permanent connection of the gin pole side guys on the center line of the pin attaching the bottom end of the gin pole to the back end of the body.

This arrangement permits detaching the gin pole from the cross-shaft, allowing an increase in the length of the head guys, which makes it possible to lean the tip of the pole further back in picking up loads at a greater distance from the rear end. When restoring the pole for traveling position, this has the further advantage of making it unnecessary to disturb the permanent anchorage of the gin pole side guys.

To work a manila line over the niggerheads to better advantage a universal fairlead block was installed on both right and left rear corners of the body. This permits working the niggerhead line at any angle from vertical upward to vertical downward whether the nigger is used on right or left side of truck.

Each fairlead block is made with a quickly demountable pin for the sheave to facilitate removing and replacing in the block when reeving line.

The crew cab has been eliminated and the men now ride on two board seats crosswise inside the body. Another innovation in the body is that instead of fourteen small compartments and doors, this has been reduced to three larger doors forward on each side. There are also small compartments above the winch on each side, one compartment below the frame back of the rear wheel, one below the frame forward of the rear axle, and a compartment clear across for carrying a cross-cut saw. Drawers beneath the side doors complete the storage facilities. In other words, Beach has designed more "built-ins" than the average woman can think up for her kitchen, and all of them easy to get at.

In the new truck, above the structure where the racks are, instead of canvas walls as in the 1938 models, steel panels are used, removable for repair in case of injury. The canvas roof is still used, supported on tubular bows.

The body is also provided with a weatherproof cab-to-body connection. It is entirely of metal except for a rubber gasket, which allows the body to weave independently of the cab and insures a weatherproof connection.

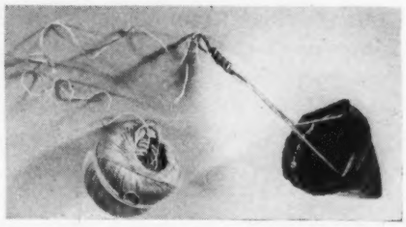
In the case of the 1938 trucks, high-strength, low-alloy steel was used and continuous welded joints were made as far as consistent with good practice. In the new body this quality of steel could not be obtained, due to priority regulations. Therefore, common open-hearth sheet was employed, with continuous arc-welded joints restricted to the structural elements of the body. Spot and tack welding as well as sheet metal screws were used in other parts of the body.

The 1938 bodies weighed 1,960 lb. The new body weighs 3,600 lb. This truck has a gross loaded rating of 16,500 lb., which is 10 percent more than the 1938 model. This difference offsets the greater body weight, resulting in the ability to carry the same pay load as the earlier trucks. The difference in over-all cost is $114.87 over the 1938 model. The new truck lifts and sets anything up to and including a 90-ft. pole.

**NEW LINE TRUCK of Northwestern Electric Co. has improved gin pole rig and unusual storage space; lifts and sets up to 90-ft. pole**

## Underground Lines

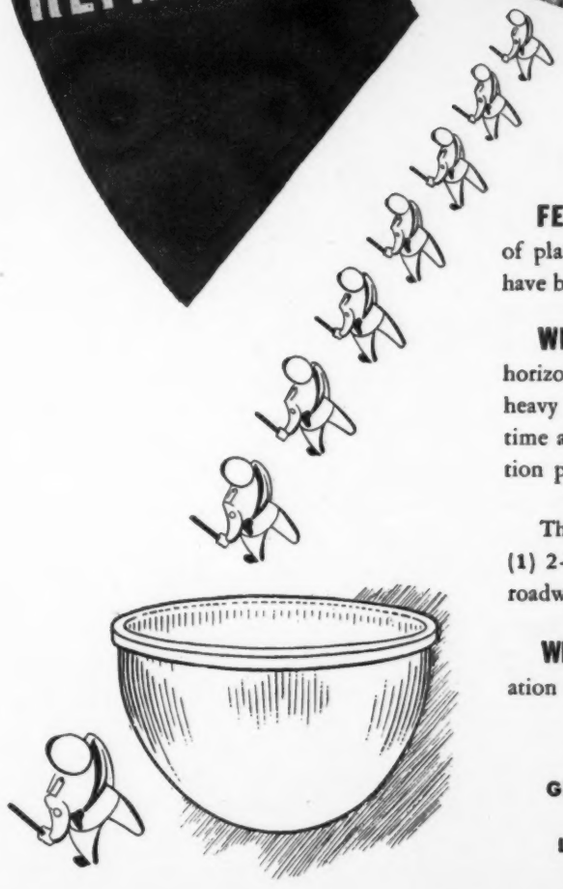
### Mechanical Rat Laces Duct Line



Today mechanical duct rats of devious designs have replaced the live rats which a few decades ago were used, with light cord attached to their collars, to lace duct lines between manholes. Dayton Power & Light Company uses the illustrated compressed-air-impelled parachute. Dayton's "rat," consisting of a discarded diaphragm from a gas meter, some pieces of scrap wire and a ball of light twine, is blown through the duct with compressed air. With it, stretches of from 500 to 700 ft. of duct have been laced in from 33 seconds to a minute and a half. This method was used recently to lace some 60,000 ft. of duct line terminating in the company's new Webster substation.

# *Protect*

## YOUR FIRST LINE OF DEFENSE *with* HOLOPHANE REFRACTORS



**FENCE LIGHTING** is an indispensable factor in any effective system of plant protection. Holophane Refractors, designed for this purpose, have been installed in over 350 major armament plants in recent months.

**WHY REFRACTORS?** . . . They control the light vertically *and* horizontally, shaping the light to the specific job needs . . . Made of heavy prismatic glass, they are durable and impervious to the effects of time and weather. Their high output efficiency and controlled distribution permit wider spacings to reduce operating and maintenance costs.

Three types of refractors are most widely used for protective lighting; (1) 2-Way asymmetric, for fence lighting; (2) C-Way asymmetric, for roadways; (3) Symmetrical, for yards and gates.

**WRITE FOR COMPREHENSIVE BOOK** of specifications and installation methods for protective lighting, sent without cost or obligation.

*Complete units, equipped with Holophane Refractors, are made by*

**GENERAL ELECTRIC COMPANY**
Schenectady, N. Y.

**PHILADELPHIA ELEC. & MFG. CO.**
Philadelphia, Pa.

**LINE MATERIAL COMPANY**
Milwaukee, Wis.

**WESTINGHOUSE ELEC. & MFG. CO.**
Cleveland, Ohio

**HOLOPHANE CO., INC.** *Lighting Authorities Since 1898* **342 MADISON AVENUE, NEW YORK**

HOLOPHANE CO., LTD., 385 YONGE STREET, TORONTO, CAN.

**YOUR PLANT IS SAFER WITH HOLOPHANE REFRACTORS**

# SUBSTATION CONDUIT STRUCTURE

## *TEN-MINUTE FOOTING*

Substations

**1** Spotted over foundation setting and with tubular steel form suspended from crane the pole-hole digger proceeds to drill the 7-ft. hole

In the expansion of Wisconsin Public Service Company's Bayside plant at Green Bay to house a new 30,000-kw. unit, 36 concrete foundation footings had to be placed for substation conduit structures running from two new substations in the plant yard to the plant proper.

Because of a labor shortage and a need for speed, engineer Elmo Schlei determined that a pole-hole digger mounted on a derrick truck offered time-saving opportunities; it placed each footing in ten minutes. To dig footings, set forms, pour concrete and pull forms conventionally was a 2- to 2½-hour job.

Footings were to go 9 ft. deep and be covered by a 2-ft. square foundation for the structure base. But the digger carried only a 7-ft. auger. By mechanically digging a 2-ft. trench the width of digger truck, the necessary depth could be secured by driving it through the trench from location to location.

**2** Having reached 7-ft. depth auger is removed, tubular form is dropped in place and the 9-ft. steel reinforcement placed

**3** While reinforcing steel is steadied, a concrete-mixer truck places its delivery shoot over the form and starts pouring

**4** Pouring complete, digger crane draws form and starts for next location as extra mix is added to top of setting. A square wooden form will be built around rods and the crown of the footing poured later

# PEMCO *Lighting*

*makes it Safe to Work . . . . Dangerous to Trespass . . . .*

**PHILA. ELECTRICAL & MFG. CO.**
1206-36 N. 31st ST.,
PHILADELPHIA, PA.

No. 633 Fence and Yard Lighting Unit. Cast Iron skirt, tapped 1¼" for series circuit, 6000 lumen lamp. For multiple circuit specify No. 633A. This Unit supplied with Holophane Bowl Refractor for symmetric, four way, two way or three way distribution.

**CAT. No. 633**

No. 379 Yard Lighting Unit. Cast Iron canopy, mogul or medium multiple socket for 300 watt lamp. Holophane Symmetric Bowl Refractor. For 150 watt lamp specify No. 374 equipped with 7" Holophane Symmetric Refractor.

**CAT. No. 379**

No. 624RS Fence Lighting Unit with specular reflector and Cast Iron canopy. External wiring. Holophane two way Refractor. Series circuit for 6000 lumen lamp. Horizontal and vertical positioning. Wood pole or wall mounting. For multiple circuit specify No. 624RM.

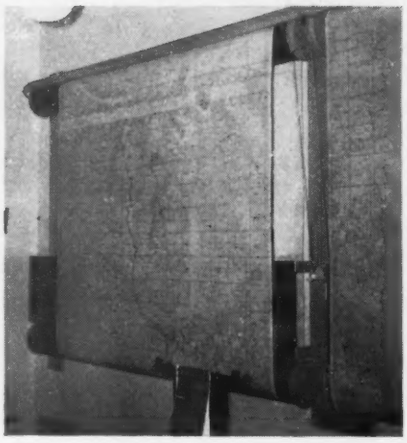
**CAT. No. 624RS**

**Pemco Protective Lighting Units are being used extensively throughout the country for ordnance and defense plants. For more complete literature and details request your copy of the latest catalog No. 85 revised.**

## Pole Lines

### Endless Belt Map of Distribution

Roller-type distribution maps used at the operating headquarters of the Dallas Power & Light Company are linen-backed and arranged in an endless belt which runs over 8-ft. long cloth-covered metal rolls 8 in. in diameter. Top or driving roll is turned in either direction by an endless cord looped about a narrow drum on the right end of the top roll. A 20-in. board is used behind the map as a rest for making corrections.



**ENDLESS belt map shows distribution system**

## Lighting

### War Plant Drafting, Long-Hour Lighting

Uniform illumination throughout all hours of work is approached in this installation of continuous fluorescent lighting in the drafting room of an Eastern factory actively engaged in the production of machinery vital to the war effort. An intensity of 70 ft.-candles is received on the boards from strips of 100-watt units, each 5 ft. long, mounted in troughs 12 ft. above the floor and spaced 5 ft. apart on centers. The room is 60 ft. long x 40 ft. wide. Only 4 watts per sq.ft. of lighted area is used, but the hours of operation are long under present conditions, and the installation provides a desirable load for the utility serving the company, as it is utilized much of the time regardless of outside weather conditions.

The lamps are of the white type, radiating little heat and insuring great comfort to the employees, besides effecting economy in the use of the plant air-conditioning system. Fixtures are of the troffer type, the lower portion holding Holophane glass lenses flush with the ceiling and providing for flux distribution in the desired directions, with even diffusion in the working space. In the plant office alone about 2 miles of fluorescent lighting is in service. The fixtures can readily be transferred to new locations in case rearrangement of office space is necessary.

**FLUORESCENT LIGHTING, used regardless of outside weather conditions, provides 70 ft.-candles on drafting boards**

## New Development

### New Glass Treatment Reduces Reflection

**By DR. F. H. NICOLL**
RCA Manufacturing Company, Camden, N. J.

A new and simple process has been developed for reducing the reflection from large areas of glass. Glare is practically eliminated and a marked increase in transmission, such as visibility of meter scales and similar devices, can be obtained.

**ONE-HALF (right) of glass cover has been treated to reduce reflection. A marked difference in contrast and visibility of the ammeter scale is noticeable**

Glareless glass must have other characteristics besides reduced reflection. The treated glass surface should be hard and readily cleaned by ordinary methods. It must not deteriorate on exposure to the atmosphere, and it should be available in large sheets by a process which, in itself is not too expensive.

The new process developed at RCA Laboratories consists of exposing the glass surface to dilute hydrofluoric acid vapor, etching away a small amount of the surface. This has been done by placing the glass over a shallow tray containing the acid solution. Tray and solution are maintained at the correct temperature by a water

# New REFRACTOLUX LUMINAIRE

## GIVES New SAFETY FOR WAR PRODUCTION

SG-10 shown in quarter-section cut-away.

## How a "Wall of Light" Blocks Plant Sabotage

Here is another substantial contribution by our lighting engineers to sustain and safeguard America's 24-hour war production schedules. It's the Westinghouse Type SG-10 Refractolux Luminaire.

This new Refractolux combines a steel-protected silvered glass reflector with better methods of light control. When installed on the sides of industrial plants or on properly located poles, the units produce a protective "wall" of intense light. Trespassers are immediately revealed as they approach plant boundaries, fences, storage areas or production centers.

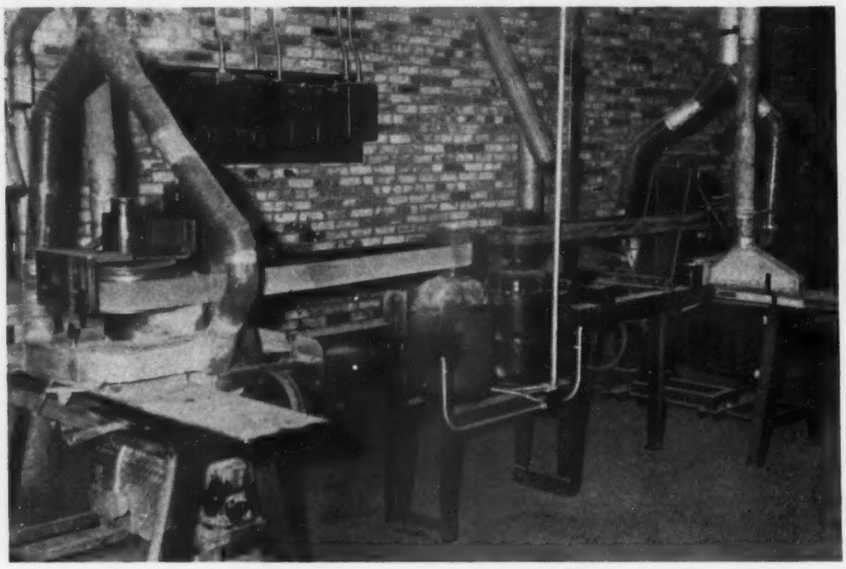
We've designed this high-candlepower luminaire to assure effective, night-after-night protective lighting. SG-10 is typical of Westinghouse *engineered seeing*—the combination of scientifically designed fixtures expertly applied to achieve the best visibility conditions. Full data is available in our new Protective Lighting Planning Book, B-3085. Write Westinghouse Electric & Mfg. Company, Edgewater Park, Cleveland, O.

The SG-10 consists of a canopy, high or low voltage type for internal or external wiring; a socket, mogul multiple or series type; a sheet steel housing that protects the glass reflector; a silvered glass reflector, cushion-mounted to absorb shock; and either a refractor or globe. Canopies, wiring and mounting arrangements and glassware are all interchangeable. A porcelain enameled shield, with refractor type units, redirects light from the pole side, and a hand-operated toggle latch releases the hinged globe or refractor for safe, easy maintenance.

**Westinghouse**

*Lighting Equipment*

## Special Stand Meets Mounting Problem



Industrial Power

Formerly powered by a vertical shaft driven in turn by an overhead line shaft, these two chalk grinders in the Muskegon, Mich., plant of the Brunswick-Balke Collender Company offered a problem in motorizing when the plant was recently changed over to individual motor drive. It was solved, as shown, by mounting the individual 7½-hp., totally inclosed, 1,740-r.p.m. motors vertically pulley-end-up on a special angle iron frame between the grinders so that the drive belt was still horizontal as before. Note the neatly grouped controls on wall.

bath. As the exposure time increases the reflection of the glass decreases, until finally a minimum is reached, at which point the glass is removed. A similar treatment is then given the other side.

By the new method there is produced a film (calcium fluoride) of desired mechanical properties, which reduces the glass reflection to about 6 percent of the original reflection and, in the case of a single piece of glass, increases the transmission quality to about 7 percent greater than its original value. These results are shown in the illustration.

Film deposited on each surface of the glass has a thickness of about one-quarter of a wavelength of light. Its color is purple, indicating that yellow and green, to which the human eye is sensitive, are not reflected. It can be subjected to a temperature of 850 deg. F. without danger of serious impairment. Glass surfaces so treated withstand hard rubbing and can be cleaned with various solvents, soap and water, or liquid window cleaners. The process outlined here produces a film of definite thickness and refractive index as well as the desirable mechanical properties.

The chemical process or treatment is applicable to large sheets of glass, to a number of types of window glass and plate glass containing calcium, including types usually used on electrical instruments. Other applications for the treated glass are lenses, recording gages, protective observation windows in apparatus containing high-voltage equipment, and covering for blueprints, graphs, etc., which are to hang on the wall, also showcase glass.

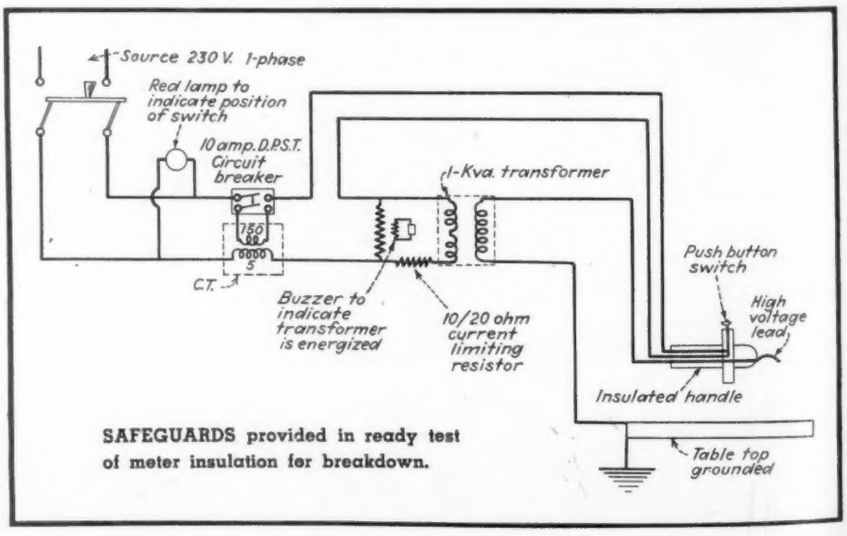
Meters

## Meter Insulation Tested on Table Rails

C. IATONNA
Superintendent of Meters
Pennsylvania Power Company, New Castle

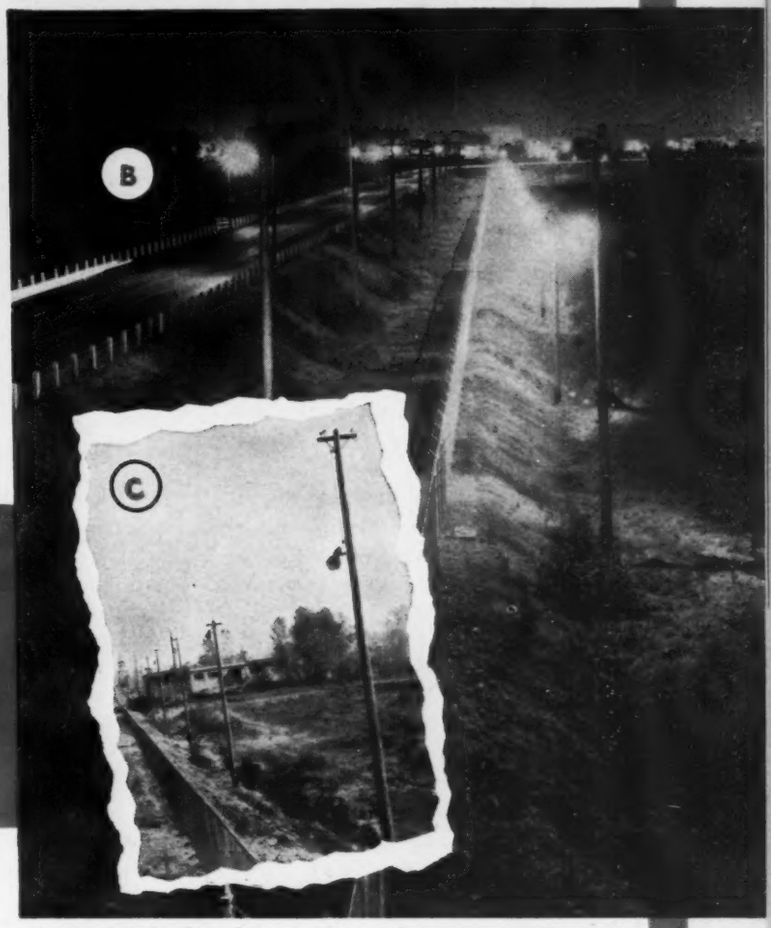
All watt-hour meters brought in to the shop for test are given a high potential test for insulation condition. This is facilitated in case of socket meters by providing on the surface of the table top a pair of rails spaced to fit the socket bayonets of the meters. These rails are grounded and also tied to the grounded terminal of the high-voltage secondary of the step-up test transformer. The other side terminates in a bare prong projecting from a well-insulated handle, which also carries a push-button switch to control the energizing and deenergizing of the test transformer.

In case of breakdown of the meter insulation during the test a 150/5-amp. current transformer (with 5-amp. winding in the supply to the test transformer primary) opens a single-throw, double-pole breaker in the other side of the supply. A red lamp and a buzzer signal the energizing of the test transformer, which has a 115/230-volt primary and a 3,000-volt secondary with twelve 250-volt steps. Meterman wears rubber lineman gloves while making test.




**SAFEGUARDS provided in ready test of meter insulation for breakdown.**

# What Makes THIS PROTECTIVE FENCE LIGHTING So Good?




## It's Exact Control of VISIBILITY and GLARE with Form 79VR Luminaires

GOOD protective fence lighting should provide these three advantages:

- An adequate volume of light
- Sufficient overlap to prevent a dark area if one lamp in the circuit should fail
- Freedom from objectionable glare

That's exactly what you get when you use G-E Form 79VR luminaires. Two diametric beams—with more candlepower at the high angles—"reach out" farther and interfere less with visibility than any conventional two-way distribution. The universal-bracket hood suspends the luminaire vertically to light a 40-foot band along the fence, or permits tilting to light an approach area up to several hundred feet wide. Tilt permits the patrol area back of the pole line to be in comparative darkness; the guard, screened from the intruder by the direct beam of the luminaire, has a clear view across the shadowless area.

Instead of experimenting with new types of equipment, see a G-E representative. He may have the answers for you. If not, he can call on our Illuminating Laboratory for recommendations. Thus you'll get the benefit of our already wide experience in protective lighting. *General Electric, Schenectady, N. Y.*

**A.** Form 79VR luminaires spaced 150 feet apart and 12 feet back of the fence line put a uniform level of illumination on every foot of the boundary.

**B.** Guards have a clear view down the fence line. There are no dark shadows to offer concealment.

**C.** Day view shows how luminaires are tipped to illuminate a wider area.

*General Electric and its employees are proud of the Navy award of Excellence made to its Erie works for the manufacture of naval ordnance.*

451-67-3200

GENERAL ELECTRIC

# LOAD BUILDING

## Ultraviolet Reduces Hospital Infections

New ammunition for lighting engineers is provided for Dr. Deryl Hart, a surgeon at Duke University, who has reduced the rate of post-operative infections by use of the Sterilamp.

Dr. Hart arranged eight of these low-pressure mercury ultra-violet generators in a square circumscribing the light source over the operating table. These were installed after a conclusion that a cause of post-operative infections are airborne bacteria.

Severe post-operative infections almost disappeared, it is reported, and total number of infections declined. Percentage of infected wounds dropped from 11.9 percent to 0.24 percent and in 2,463 cases there has been no mortality from post-operative infection.

Other hospital applications of the Sterilamp are for protecting each baby in its crib in the hospital nursery and for creating sterile zones in wards for children with contagious diseases.

The 12-watt lamp is also used to reduce propensities toward molding in bakeries, in package products like face creams, tooth paste, foods, serums and vaccines, as well as in vats of syrups for soft drinks.

•

## Develop Infra-Red Seed Conditioner

By JOHN E. NICHOLAS,
Professor of Agricultural Engineering,
Pennsylvania State College

An infra-red continuous seed drier has been developed to meet the need for seed conditioning incidental to the commercial production of pasture grasses of practical importance to Pennsylvania.

The present tendency toward the "combine-harvesting" of grain and grass and legume seed makes the rapid and economic drying of seed as it comes from the field so harvested become imperative and necessary if the products are to be safely stored. This drier offers the desired answer to this new problem. It has 40 250-watt lamps arranged in a double-row bank.

Preliminary results with the infra-red seed drier and conditioner indicate that it has definite possibilities for the rapid drying of seed without injury to germination. The following few types of seed were included: Red fescue; rye grass; tall fescue; brome grass; red clover; barley; soy beans, and wheat.

Its usefulness is not necessarily limited to drying of seed. Fruit as well as grass could be dried. It has been suggested that "awakening" of seed potatoes which have been stored under conditions prevalent in the Northern states, such as Maine, would shorten the period between planting and sprouting.

While the capacity of the particular equipment used in the tests is limited as above indicated, it would seem to be entirely practicable to get capacities to meet individual requirements by adjustment of lamp numbers and belt sizes.

**CONTINUOUS SEED DRYER WITH INFRA-RED—Developed at Pennsylvania State College, this 20-ft. infra-red double-row bank dries seeds quickly and without injury to germination, in from four to eighteen minutes. Forty 250-watt infra-red lamps are used**

•

## Large Lighting Sales by Memphis Employees

By R. S. DIGGS
Director Commercial Department,
Memphis Light, Gas & Water Division,
Memphis, Tenn.

Although the Memphis Light, Gas and Water Division operates without a formal sales department as such, nevertheless 549 employees sold 10,600 kw. of incandescent lamps in the latest two-month campaign and

# *Who will see to it . . .*

# *THAT 18 MILLION WAR WORKERS HAVE THE RIGHT LIGHTING?*

IF we're going to have 18 million men and women producing war materials by the end of this year, we should be adding them at the rate of 250,000 a week. Whatever the rate, millions of hands and eyes are going to be wrestling with new and intricate seeing problems. This places a tremendous new responsibility on those of us whose job it is to increase production with lighting.

Who's going to do this job? And how is it going to be done?

Shouldn't we as the lighting industry, knowing the facts about the relationship between proper lighting and increased production, step up our tempo of customer contact and service?

Shouldn't we seek out all plants, large and small, who are faced with the problem of how to get the most out of one shift, two shifts, three shifts, and make sure that we are helping that plant management remove all the bottlenecks that occur from improper* lighting?

Shouldn't we organize in each community to see that every available man in the lighting industry not only knows how to prescribe light for increased production, but is out doing the job every day?

### TELLING THE STORY

General Electric is ready to help every utility tell this story. In addition to engineering service and complete programs and bulletins now available through our Lamp Divisions and Nela Park, General Electric offers its total lighting manpower in this vital war effort to increase production with lighting. General Electric Company, Nela Park, Cleveland, Ohio.

**Improper lighting is not necessarily too little lighting, but may result from dirty fixtures and lamps, glare, and shadows. Correction of these is vitally important in improving lighting.*

## G-E MAZDA LAMPS

## GENERAL ELECTRIC

*There's a* G-E MAZDA *lamp for every lighting need.* MAZDA *is not the name of a thing, but the mark of a research service.*

RUBBER COVERED POWER CABLES • BUILDING WIRE
BARE WIRE • MAGNET WIRE • SERVICE ENTRANCE CABLE • VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE
CRESFLEX NON-METALLIC SHEATHED CABLE •
TO HELP WIN THIS WAR
CRESCENT
Manufactures
ELECTRICAL WIRES & CABLES for POWER to Speed VICTORY

CRESCENT is all out for WAR.
CRESCENT INSULATED WIRE & CABLE CO.
CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—Stocks in Principal Cities
CRESCENT ENDURITE SUPER • AGING INSULATION

one employee sold 718 kw. of lamp bulbs.

Average lamp wattage for the campaign was 73.6, average sale was 2.4 lamps per domestic customer with 18,988 separate orders involved.

The campaign a year ago resulted in sales of 4,670 kw. of lamp bulbs to residential users.

We followed a streamlined program in our latest 10,000,000-watt campaign. The only advertising employed consisted of 90,000 two-page bill inclosures. Instead of a series of meetings, we held one meeting, attended by department directors and department heads only.

From then on the job of advising and directing employees was up to these officials. The excellence of their job is attested by the fact that the final sales results represented 303 percent of quota.

As long as manufacturers can supply us with lamps (see ELECTRICAL WORLD, February 7, 1942, page 63), we expect that these lighting campaigns will provide an important source of essential revenue for our operations.

•

## Used Fixtures Help Build Lighting Load

By MARCUS S. GILBERT,
Illuminating Engineer Indianapolis Power & Light, Indianapolis, Ind.

In these days of priorities, shortages and limited commercial production utility lighting salesmen in companies with spare capacity are finding it increasingly difficult to build lighting load because customers, persuaded to relight certain areas, find themselves unable to buy the required new equipment.

The opportunity still remains, however, to build lighting load with those old incandescent indirect lighting fixtures that have been replaced by fluorescent units, and that are reposing on customers' storage shelves. In some cases these can be bought up and put into use where customers need better lighting, but either cannot get or do not wish to spend the money required for new lighting units. There still are customers who are using bare incandescent lamps. When peace comes customers who have been sold on higher lighting levels will still be

in the market for more up-to-date lighting.

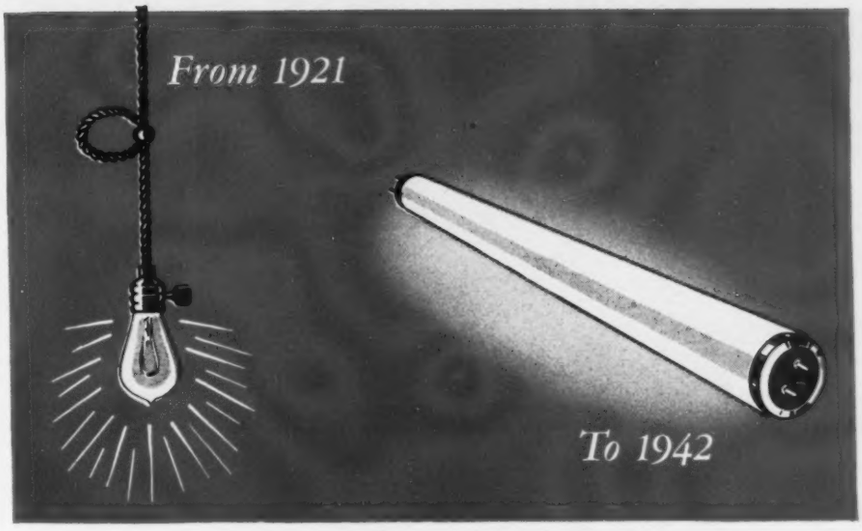
The successful lighting salesman may well make a survey of relighting jobs installed during the past year or two and find out what has happened to incandescent fixtures that were replaced by fluorescent units. In a good many instances fairly new indirect units or inclosing globes will be found in storage which many owners will part with for from 25 cents to $5 each.

The next step is to make a survey of his d.c. customers who will be unable to change over to a.c. for sometime to come and who would be more than glad to relight if they could buy the fixtures "for a song." In some cases he will find customers who had planned to buy new indirect fixtures, but, being unable to get delivery from the manufacturers, will be glad to take the used fixtures. Then, too, there are many small a.c. customers who need better lighting and do not wish to spend the amount required to obtain fluorescent fixtures. Many would gladly pay $20 for six or eight good indirect incandescent fixtures. There are a number of customers who would pay 50 cents or $1 for a 200- or 300-watt inclosing globe fixture.

### *Sells Used Units*

For example, in Indianapolis a customer who was installing fluorescent equipment was pleased to part with 43 500-watt semi-indirect lighting units about three years old and in good condition for $5 each, including the partly used lamps. The manager of a d.c. office building bought these units to replace old 150-watt inclosing fixtures because they matched some indirect units already installed. Thus, there was a gain of 350 watts per fixture, or a total of approximately 15 kw., which more than offset the loss in wattage that was caused by the first customer installing fluorescent lighting.

Just because new fixtures are hard to get one should not discontinue efforts to build lighting load. Find a home for those old fixtures; they do no one any good while resting on a shelf. Our jobber and manufacturer friends won't mind, since they are unable to deliver and, in a good many cases, may not even wish to be bothered with small orders as long as their men are being kept busy on large contracts.


# INDUSTRIAL LIGHTING SPECIALISTS

Even in these war-busy days, a 21st birthday seems important enough to warrant a little celebration... and we have been at this lighting business now since the beginning of Warren Harding's administration, way back in the "good old" flapper-and-speakeasy days.

As specialists in the research, design and fabrication of equipment for the broad fields of industrial, commercial and flood lighting, we have developed many dependable ways to control incandescent, mercury vapor, fluorescent—*and now the new RF*—light sources to achieve maximum efficiency.

Why not put *your* lighting problems up to a specialist? Bright Light Reflector Co., Inc., 1035 Metropolitan Avenue, Brooklyn, N. Y.

*Write for one or both of these Silv-A-King Lighting Guides: LG1 — Fluorescent, or LG2 — Incandescent.*

*Quality and dependability through two decades have linked the Silv-A-King name with such famous names-in-industry as:*

AC SPARK PLUG
BETHLEHEM STEEL • BUICK
CHEVROLET • GENERAL MOTORS
FISHER BODY
INTERNATIONAL HARVESTER
JONES & LAUGHLIN STEEL
PITTSBURGH PLATE GLASS
RUPPERT BREWERY
WARD BAKING
*and many others*

SILV-A-KING
FLUORESCENT

SILV-A-KING MAKES *Light* WORK FOR YOU

# NEW EQUIPMENT

## Blackout Lamp

Lamp unit with red lens is said to give undetectable light during blackouts. It is designed to fit any standard socket and

Blackout lamp; equipped with red-tone lens, uses 15 or 25-watt bulb, dimensions 5x5 in. **Globe Lighting Fixture Mfg. Co.**, 16 East 40th St., New York, N. Y.

claimed to be suitable for use in homes, offices and buildings. Bulbs may be replaced.

•

## Flashlight Wet Cell

To provide a "permanent" source of energy for flashlights for use during blackouts as well as other emergency and industrial purposes, a rechargeable battery is available which is said to be spillproof

Rechargeable flashlight battery; capacity 2 amp.-hr., 2.2 volts open circuit. Dimensions, 1¼ in. diameter by 4¾ in. long. **Ideal Commutator Dresser Co.**, 1021 Park Ave., Sycamore, Ill.

and fits standard cases. New design of wet cell has a chamber in which the exact amount of liquid necessary for maximum operation is held and is plainly visible. Water is added to the storage battery by means of a medicine dropper. It is claimed that with proper care one battery can give up to 1,000 hours or more of dependable light service. Single and gang chargers can be furnished.

•

## Paint

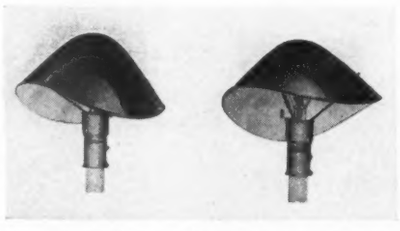
Luminous paint; fluorescent and phosphorescent. **Vita-Var Corporation**, Newark, N. J.

A high-intensity paint has been developed for use with markers for strategic points as safety or economy measures in case of lighting failures or blackouts.

•

## Lighting Fixtures

Two styles of fixtures, both suitable for mounting on a standard 2-in. pipe, for protective lighting have an elliptical shape



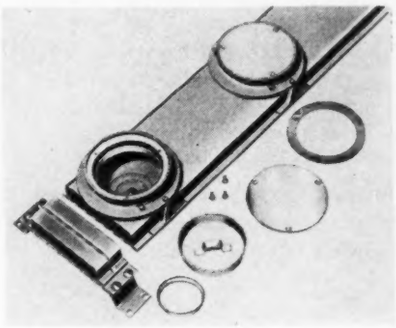
"Elipso Standlite" lighting fixture. "Direct style" (left) delivers light laterally. "Angle style" provides a slight forward throw. Both can be used with 300- to 500-watt lamps. **Goodrich Electric Co.**, 4600 Belle Plaine Ave., Chicago, Ill.

which are to provide a wide lateral distribution of light. With proper spacing, a brilliant barrier of light is said to be created around property lines without illuminating buildings and grounds. Fixtures are designed to conform to FBI specifications.

**BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

## Electrical Fittings

Complete line of electrical fittings for underfloor distribution systems used with Robertson Q-floor can be obtained from



Q-floor electrical fittings and accessories (standard header duct illustrated). **General Electric Co.**, Bridgeport, Conn.

the company. It includes standard header-duct for installation on top of cells, slot header-ducts for installation in top section of cells, ceiling header-duct for installation on the cells, suitable for underside wiring, high-tension and low-tension outlets, also accessories to connect panel to Q-floor, to connect conduit to Q-floor, for the finished floor, and tools.

•

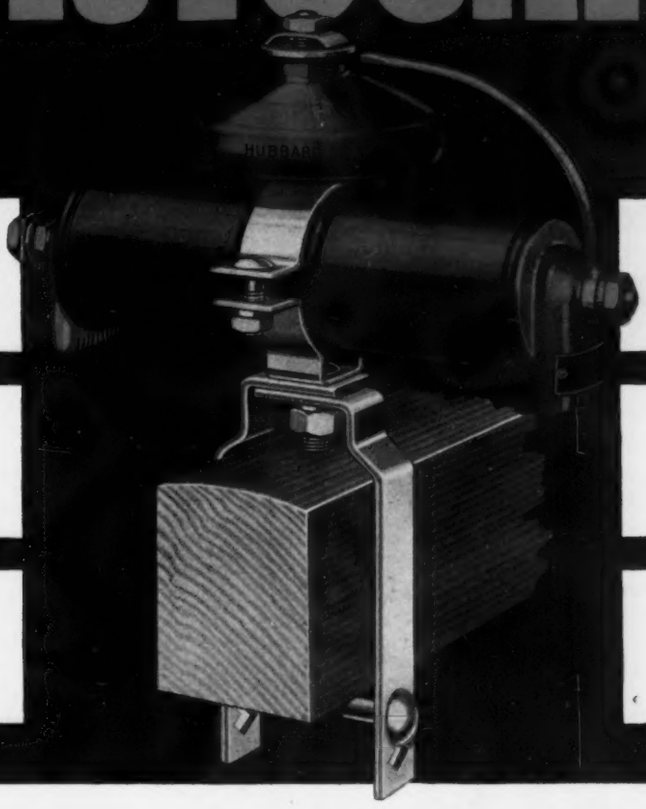
## Sequence Timer

Sequence timer for automatic resistance welding has electronic timing circuit con-

Resistance welding sequence timer; weld period of 3 to 30 cycles when full welding current flows. Control transformer wound for 115/230/460/515 volts, 50/60 cycles. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

# LIGHTNING PROTECTION

# WITH AUTOGAP ARRESTERS



**RELIABLE CO-ORDINATED LIGHTNING PROTECTION**

**EXTREMELY HIGH SURGE CAPACITY**

**WEATHERPROOF— UNAFFECTED BY SLEET OR SNOW**

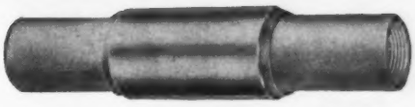
**SAFEGUARD YOUR MOST TROUBLESOME SPOTS**

**WILL NOT LOCK OUT FEEDERS**

**MOUNTINGS FOR POLES, TRANSFORMERS OR CROSSARMS**

## LIKE A GUN BARREL

### Steel-Reinforced to Withstand DISCHARGE



The Hubbard Autogap Arrester, on the market and available for the short span of two years, has already demonstrated its superiority. Installed, deliberately in troublesome spots, this arrester has solved the Lightning problem of a large number of users throughout the United States.

## *"Hang the Load on Hubbard Hardware"*

| Stock No. | Phase to Phase Circuit Voltage | | | | Max. Arrester Voltage Rating | 60 Cycle Test Value Kv. Rms. | Min. Impulse Breakdown Voltage 1½-Kv. Crest 40 Micro-Seconds | Weights | |
|---|---|---|---|---|---|---|---|---|---|
| | Ungrounded | | Grounded | | | | | Net | Shipping |
| | Min. | Max. | Min. | Max. | | | | | |
| 2300 | 1000 | 3000 | 1000 | 5000 | 3000 | 19 | 30 | 8 lbs. 3 oz. | 10 lbs. |
| 2301 | 3000 | 6000 | 5000 | 9000 | 6000 | 25 | 40 | 9 lbs. 11 oz. | 10 lbs. |
| 2302 | 6000 | 9000 | 9000 | 13800 | 9000 | 32 | 60 | 9 lbs. 11 oz. | 11 lbs. |

## HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

Sherman solderless wire connectors and clamps are practical, efficient, easy to install, and surprisingly moderate in cost. Every item has been designed and built to meet the specific needs of the Electrical Industry. Many special features of these connectors have resulted from the specific recommendations of utility engineers.

You can cut costs and reduce inventories by standardizing on Sherman. Write today for catalog giving full specifications and list prices.

**H. B. Sherman Mfg. Company**
**Battle Creek, Michigan**

**SPLIT BOLT CONNECTORS**

Precision machined from special high strength bronze. Extra long pilot provides easy starting of nut and prevents cross threading.

**WEDGE GRIP CONNECTORS**

Special insert plate for greater thread strength. V-shaped corrugations grip wires securely. Non-removable screw.

**"BOND-ROD" GROUND CLAMPS**

For driven ground rods. Heavy extruded bronze. Special screw with cup point. Strong, one-piece construction.

**JUMPER CLAMPS**

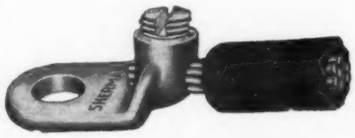
Heavy, ribbed, parallel groove clamps for jumper, tapoff, service or other wire connections. Made in a variety of types.

**TYPE S O —SOLDERLESS LUGS**

Heavy duty Solderless Lug of rigid design, with plenty of body and ample contact surface. Serrated gripping surfaces hold conductor securely.

**ARMOR ROD CLAMPS**

For making tapoffs over ACSR Armor Rods. Unique interlocking construction. Quickly installed without removing bolt.



**TYPE S M—SOLDERLESS LUGS**

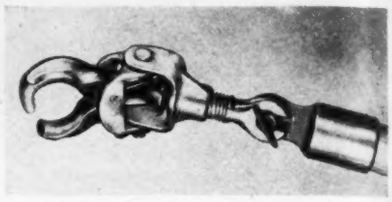
Inexpensive, one-piece Solderless Lug of pure copper. Compact, simple, and rigid. May be soldered if desired. Full range of sizes.


sisting essentially of a resistance capacitor circuit whose charging rate is adjustable by varying a resistor. Timer divides the total time of a weld into the various intervals in which the welder goes through its operating sequence, by setting of control knobs on dead-front panel. It has a standard foot switch control.

•

## Door Puller

A tool designed for opening inclosed cutouts, disconnects, etc., has round jaws



Universal cutout door puller. **A. B. Chance Co.**, Centralia, Mo.

to engage cutout and disconnect rings. The tool is not recommended for use as a door or fuse remover.

•

## Drying Agent

Florite desiccant; absorbs 4 to 20 percent of its weight in water, is regenerated by heating to 300 to 350 deg. F. **Floridin Company**, 144 Liberty St., Warren, Pa.

Desiccant material of granular structure for drying gases and liquids is said to absorb water instantly and will not swell, disintegrate, or appear wet at the end of an absorption cycle, and is hard, stable, non-corrosive, and non-poisonous. It may be used in breathers for transformers and storage tanks, to dehumidify air in air conditioning systems, and to dehydrate refrigerants.

•

## TECHNICAL LITERATURE

ARC WELDING—A 100-page manual, written in easy-to-understand English, has 42 arc-welding lessons with instructions for practicing—material, position, proper electrode, current value, and polarity setting. Patterned after the course of lessons offered in the Hobart Trade School, this book, with 77 illustrations, leads the student throughout the fundamental stages of arc welding. Copies of the book, "Practical Lessons in Arc Welding," may be obtained from Hobart Brothers Co., Troy, Ohio, at 50 cents each.

FIRE EXTINGUISHMENT — A report gives data obtained on fire extinguishing by use of bulk, low-pressure liquid carbon dioxide. Four demonstrations included an inclosed space, large outdoor pools, and outdoor transformer compartment, even with 45-m.p.h. wind. Copy of the report, "Four Cardox Fire Extinguishing Demonstrations," may be obtained from Cardox Corporation, 307 North Michigan Ave., Chicago, Ill.

RECORDING INSTRUMENTS — New 28-page booklet shows how utility systems and stations, industrial power plants, and power purchasers are effecting operating economies by indicating and recording load continuously and automatically. Description of

equipment and connection diagrams are included. This publication, Catalogue N-58-161, "Micromax Telemetering and Totalizing Recorders for Electric Power," is available from Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

LIGHT RADIATION—After a general discussion on light and the several units of measurement, the major portion of a four-page pamphlet gives an explanation of the applications of light rays in the various zones of the spectrum, illustrated by a linear scale ranging from 1,000 to 120,000 Angstrom units. A table is included on the reflecting efficiency of silver, gold, copper, aluminum and nickel surfaces for reflecting radiation. The pamphlet, "Technical Data on Wave Lengths and Angstrom Units," may be obtained from North American Electric Lamp Co., 1014 Tyler St., St. Louis, Mo.

CERAMICS—"The Electrical Properties of High-Frequency Ceramics" classifies ceramic materials into four groups: clinoenstatite bodies, rutile bodies, magnesium orthotitanate bodies, and cordierite bodies; gives dielectric characteristics of the groups, and discusses advantages of ceramic material being metal coated. This reprint, from *Electronic Engineer* (London), including Property Chart No. 416 giving mechanical and electrical properties of AlSiMag technical ceramics, is available from Research Division, American Lava Corp., Chattanooga, Tenn.

POTENTIAL DEVICES—Proposed standards for trial use apply to in-phase and out-of-phase potential devices and coupling capacitors. Copy of Publication No. 31, "Capacitance Potential Devices and Outdoor Coupling Capacitors," are obtainable from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.

AIRPORT LIGHTING AND DISTRIBUTION—Covering all the lighting and electrical distribution equipment involved in the design of an airport, a new bulletin was prepared in collaboration with the C.A.A. and has its full approval. Recommendations are given for airports with runways of from 1,500 to 4,500 ft. and typical lighting wiring diagrams are included. A copy of bulletin B-3046, "Airport Lighting and Distribution Equipment—C.A.A. Approved," may be obtained from department 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

LIGHTING—Lighting to conform with War Department QGM No. 6403 E and Ordnance Department Plant Security Division Requirements are listed in a 10-page pamphlet entitled "Lighting for Ordnance Plants and Works." This publication lists the types of fixtures required for use in powder plants and arsenals and includes methods and diagrams for protective lighting for outdoor areas. The company's line of fixtures are listed for the various applications as well as blackout lighting. The pamphlet may be obtained from Holophane Company, Inc., 342 Madison Ave., New York, N. Y.

WET TESTS — Specifications have been adopted to establish a general standard method for use in making high-potential tests on insulators, bushings, switches and related apparatus. It covers only the requirements for the spray and the correction factors to be applied to test results. Copy of AIEE publication No. 29, "Standards for Wet Tests," may be obtained from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y. Price 40 cents to non-members in U.S.A.

# AND PYREX INSULATORS GIVE YOU BOTH

**MORE PERFORMANCE . . . AT LOWER COST**

***Save on initial cost and installation***

"PYREX" 10-in. Insulators are now 8 to 13% lower in price than competitive 10-in. units.

"PYREX" 9-in. Insulators are now 17 to 21% lower in price than competitive 10-in. units.

Stable one-price-to-all basis. Fewer than ½ as many price changes for "PYREX" Insulators as for competitive units in past 5 years.

Installation of "PYREX" strings with patented hinged crate is speedier. High M & E strength of "PYREX" Insulators usually makes double stringing unnecessary.

***Save on performance and maintenance***

"PYREX" 18,000-lb. suspension units duplicate the performance of 25,000-lb. competitive units. And in M & E tests at 25,000 lbs. and higher, 95% of breaks are in hardware, not in glass.

No "PYREX" Insulator has ever been reported to us by users as having failed from electrical causes alone.

A recent independent analysis indicates "PYREX" Insulators will eliminate ⅓ of all failures (electrical and mechanical).

SMART insulator purchasing was never more important than now! Nor so easy. For now you get two-way savings with PYREX Insulators. First, initial cost is lower. Second, the unequaled dielectric strength, high load strength, arc resistance, and weathering qualities of these borosilicate-glass insulators offer you freedom from trouble, uninterrupted service and long life. And that adds up to low long-time cost. PYREX brand Insulators do give you more performance . . . at lower cost.

**MAIL COUPON TODAY FOR FREE BOOKLET**

*"Plain Facts about Insulators"*

**Pyrex Insulators**
BRAND

Corning Glass Works
Insulation Division
Corning, N. Y.

Please send me my FREE copy of "Plain Facts about Insulators".

*Name* .....

*Firm* .....

*Address* .....

*City and State* .....

*"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works*

# NEWS ABOUT PEOPLE

## C. E. Houston Assumes New Duties in California

C. E. Houston, vice-president and assistant general manager of the Southern California Edison Co., has been elected general manager to succeed Fred B. Lewis. Mr. Houston also was elected to the Edison board of directors and to the executive committee of the board. Mr. Lewis, vice-president and general manager since 1931 and a member of the Edison organization since 1905, will remain with the company as a vice-president, a member of the board of directors and a member of the executive committee. Gail C. Larkin, formerly assistant general counsel, has been elected general counsel succeeding Roy V. Reppy. Mr. Reppy, general counsel since 1919 and a vice-president of the company since 1925, also will remain as a vice-president and a director. Harold R. Quinton, formerly Los Angeles resident partner of Arthur Andersen & Co., was also elected a vice-president of the company. Mr. Quinton will fill the vacancy caused by the death of the late D. M. Trott, vice-president in charge of finance.

C. E. Houston

Mr. Houston has been a member of the Edison organization for 38 years. He started as a lineman and has had wide experience in both the operating and commercial departments of the company. He became head of the commercial department in 1936 and was appointed assistant general manager in 1939, becoming a vice-president the following year. Mr. Houston was president of the Pacific Coast Electrical Association in 1940-41.

H. R. Quinton

Mr. Quinton has been Los Angeles resident partner of Arthur Andersen & Co. since 1928. He formerly was associated with the Chicago office of the company.

•

▶ HOWARD M. TURNER, consulting engineer, Boston, Mass., and a lecturer at the Harvard Graduate School of Engineering, has been elected vice-president of the Boston Society of Civil Engineers. Mr. Turner was connected with the Turners Falls Power & Electric Co. for some years in relation to the hydroelectric developments of that organization in the central Connecticut Valley, before entering private practice.

## Landers Made General Manager in Findlay

Frank C. Landers has been elected vice-president and general manager of Central Ohio Light & Power Co., Findlay, Ohio, to succeed A. W. Conover, resigned. The election of Mr. Landers marks his reassumption of the active management of the Central Ohio Light & Power Co., from which he retired late in 1939 to live in Miami.

Mr. Landers was connected with the Niagara, Lockport & Ontario Power Co. from 1905 to 1920, occupying the position of superintendent at the time he resigned to take over the management of the Cambridge district of the Eastern Shore Gas & Electric Co. in Maryland. In 1921 Mr. Landers went to south Georgia as vice-president and general manager of the Valdosta Lighting Co. and later, following the acquisition of the Ware County Light & Power Co. at Waycross, took over the management of that company. Both of these companies were engaged in the sale of electricity and had large ice interests.

With the formation of the General Public Utilities Co. in 1926 he became vice-president and general manager of the Florida ice operations, but resigned to go to Louisiana in 1929, taking over the management of the Louisiana Ice & Utilities Co. along with its subsidiaries in Texas and Mississippi.

Mr. Landers became vice-president and general manager of the Central Ohio Light & Power Co. early in 1938, remaining with that company until the end of 1939, when he retired.

•

▶ L. P. SPOON has been appointed sales engineer for the Walker Electrical Co., Atlanta, Ga. Mr. Spoon was formerly with Crouse-Hinds Co., Philadelphia, and Harrison-Wright, Charlotte, N. C.

▶ F. V. WRIGHT has been named general superintendent of California Electric Power Co. to succeed George M. Wills,

# ...a NEW wire holder—
## ...sold under a NEW NAME...
# SEYLER

## . . . AND BACKED BY A HERITAGE OF QUALITY WELL KNOWN TO EVERY USER OF POLE LINE HARDWARE!

It's been 20 years since SEYLER Pole Line Hardware and Construction Materials first were manufactured and used by utilities . . . *yet the name SEYLER is new to the users of these products!*

The reason—SEYLER products, until recently, have been sold under other trade names. Now, those products which have been satisfactorily serving under these other names, *are available from SEYLER.* Like this new outstanding wire holder, they have always represented, and will continue to represent, the highest quality manufactured.

Consider SEYLER, then, before purchasing pole line hardware . . . possibly it has always been your choice under other names . . . a point well worth consideration.

This new SEYLER Wire Holder (Cat. No. 3-11-44) screws in flush against any surface, because the recessed base allows room for wood splinters, etc. Maximum grip is assured, because of the sharp threads running flush with the base. Frame and screw are hot galvanized and double dipped—porcelain body is built to withstand rough treatment and stand up under heavy loads. Write for a sample of this SEYLER product.

**ASK YOUR JOBBER FOR SEYLER PRODUCTS**

*The Finest in Pole Line Hardware and Construction Materials*

**SEYLER MANUFACTURING CO.**

SHARPSBURG POST OFFICE PITTSBURGH, PA.

# POSITIVE PROTECTION for Oil-Filled Equipment

## STOPS OIL FIRES WITHOUT CHEMICALS!

Permanently installed on transformers or other oil-filled equipment, a Grinnell Mulsifyre System will stop oil fires so fast that outages seldom result!

The instant a Mulsifyre System is turned on (either manually or automatically), high-velocity sprays of water blanket the oil... churn the surface into a non-flammable emulsion . . . stop fire in 2 to 5 seconds. There's no time for major damage . . . no chemical to corrode equipment.

**INVESTIGATE** this simple, sure oil fire protection. Write for authoritative Data Book on Mulsifyre Systems by Underwriter's Laboratories. Grinnell Co., Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of U. S. and Canada.

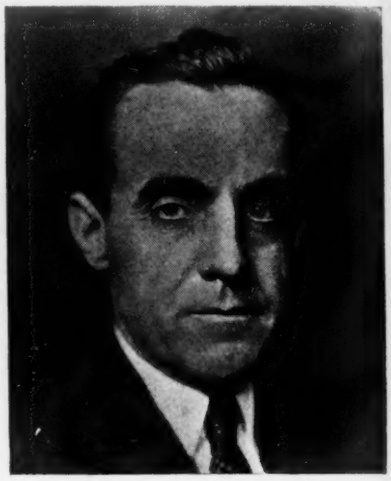
**GRINNELL**
**MULSIFYRE**
**Fire Protection Systems**


who retired recently. Mr. Wright has been with the company for approximately 24 years and has been assistant general superintendent for more than 18 of them.

•

### Hygrade Appoints Boggs Manufacturing Director

C. P. Boggs has been appointed to the position of director of manufacturing for the Hygrade Sylvania Corp. Mr. Boggs has held executive positions in the manufacturing division of the corporation since 1932. Recently he was made assistant to Executive Vice-President W. E. Poor and now assumes his new duties with a broad background of management experience as well as first hand knowledge of factory operations.

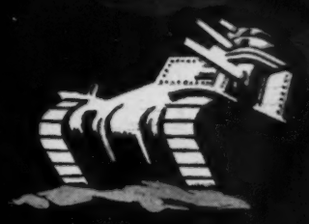


Prior to his association with Hygrade Sylvania Mr. Boggs was with the General Electric Co.

•

▶ R. C. COFFY, manager of the eastern division of the Oklahoma Gas & Electric Co., Muskogee, for the past ten years, has retired. He has been succeeded by W. R. WOLFE, sales manager of the eastern division. In retiring from active affiliation with the Oklahoma utility, Mr. Coffy terminated a service that started in 1908 and had continued, with but two interruptions, since that date. Mr. Wolfe started with Oklahoma Gas in 1926 following graduation from the University of Oklahoma. He was connected with the engineering department in Oklahoma City until 1929, when he was transferred to Muskogee as assistant commercial agent. He was appointed sales manager in 1939, which duties he continues to perform together with his duties as division manager. Mr. Coffy spent four years—1908-1912—with the company in Oklahoma City. He then transferred his interests to gas companies in the State of Washington, but returned to Oklahoma Gas & Electric in

to get 'em rolling...



# TANK PRODUCTION DEPENDS ON THIS *Vital Fraction* OF AN INCH

How much will efficiency of a blooming mill be cut by the failure of a *single commutator segment* in one of its motors? How much will plant output suffer from similar failure on a big generator?

Remember, each of these segments measures only a fraction of an inch — but if three or four fail, the equipment will go out of service! If only one fails, its efficiency will drop — a drop that America's horsepower *can't afford* in these days of peak demands.

Round-the-clock operation of motors and generators throughout industry gives you no choice. Only the *best* in insulation is good enough. Built-up mica segments must not fail — must pack maximum toughness and dielectric strength into minimum space.

That's why it pays — whether you are building, using or repairing electrical equipment — to call on *Insulation Headquarters.* In almost 50 years of research at Mica Insulator Company, we have covered in detail the application of mica to every insulating need... learned how it can best be built for your specific requirements.

We start with raw mica from our own mines — the richest deposits in the world. Then, build it up and fabricate it with the skill and methods that only a pioneer can acquire. The result, our engineers are prepared to recommend and supply you with the *right* insulation for each service — insulation that keeps motors and generators running longer and with less maintenance.

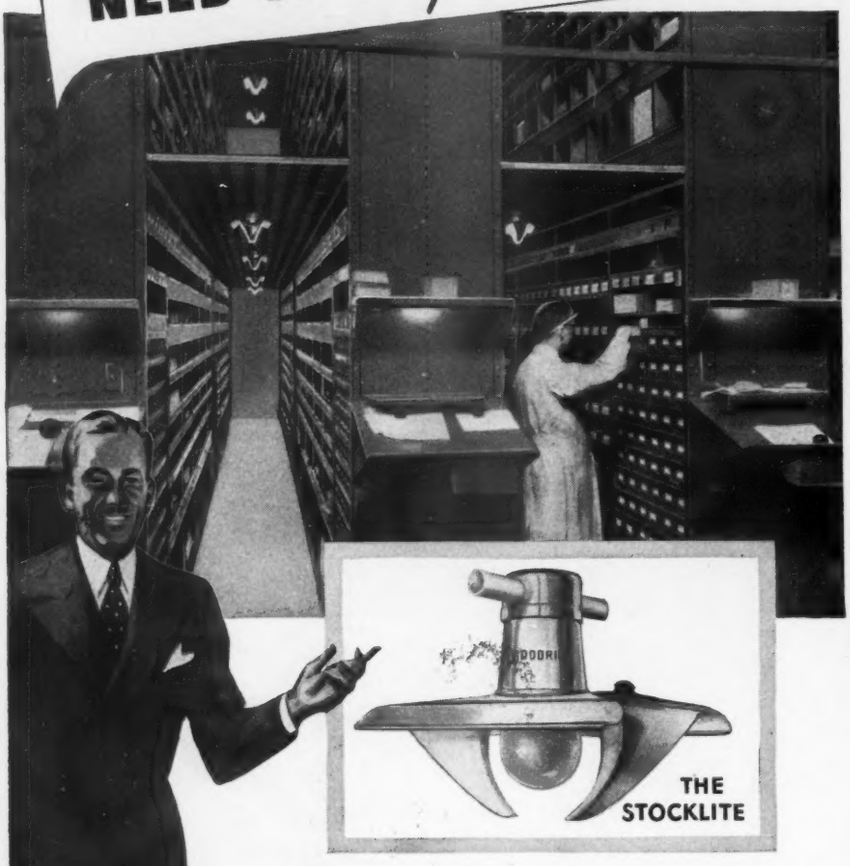
***call on***

# MICA INSULATOR CO.

***for the right insulations***

202 Varick Street, NEW YORK. 542 So. Dearborn Street, CHICAGO. 1276 W. Third Street, CLEVELAND. Representatives in principal industrial centers.

# WAR-TIME STOCKROOMS NEED THIS *special fixture*




● Today's rush orders for Victory require fast, accurate handling. To accomplish this, use the fixture *correctly designed* for the illumination of stockroom shelves and bin interiors. The Stocklite will help you speed up, save time, and avoid costly mistakes. Note how its novel design protects you from glare and eyestrain, yet throws light into bins from top to bottom row where ordinary fixtures cannot. The Stocklite is widely used by the Government and defense plants. Write for Bulletin No. 91.

**GOODRICH**
**INDUSTRIAL LIGHTING**

GOODRICH RLM

In addition to approved RLM fixtures, the complete Goodrich line includes a size and style of fixture for every industrial requirement.

**SOLD ONLY THROUGH ELECTRICAL WHOLESALERS**

**GOODRICH**
**ELECTRIC COMPANY**
OFFICES IN ALL PRINCIPAL CITIES

**GENERAL OFFICES AND FACTORY: 4626 BELLE PLAINE AVENUE, CHICAGO, ILL.**


1918. He served successively as division manager at Sapulpa, manager of the Mississippi Valley Power Co., at Fort Smith, now the Arkansas division of Oklahoma Gas & Electric, and then as manager of the eastern division at Muskogee.

•

## V. H. Moon Opens Offices As Sales Consultant

Verne H. Moon, who for many years engaged in commercial and new-business activities for various utility companies, has opened offices in Chicago as utility sales consultant.

The early stages of his career were spent with H. M. Byllesby & Co., but after World War I he became identified

*Moffett Studio*

with the Pacific Power & Light Co., of which he was made sales manager in 1931.

In 1932 he accepted a position with the receivers of the Middle West Utilities Co., Chicago, as director of commercial activities and in this capacity he supervised the commercial development of the operating subsidiaries of that group. Subsequently he became vice-president of the Middle West Service Corp., organized in 1936 to provide advisory services to subsidiaries and affiliates of Middle West Corp. In this position he pioneered in analysis and rationalization of load building costs. After D. C. Green, formerly president of Middle West Corp., organized the Central Service Corp. in Chicago, Mr. Moon joined the organization as vice-president in charge of business development.

•

► HAROLD M. TOWNE has been appointed manager of sales for lightning arresters and fuse cutouts and MAX I. ALIMANSKY manager of sales for capacitors, according to an announcement by L. R. Brown, manager of the transformer

division of General Electric's central station department. Mr. Towne has been connected with the lightning arrester business of the General Electric Co. continuously since 1909. As a member of the transformer division at Pittsfield since 1929, he has been directly connected with the sale of lightning arrester equipment. A member of the American Institute of Electrical Engineers, Mr. Towne is also a contributor to the technical press. Mr. Alimansky entered the employ of General Electric in 1926 as a co-operative student from M.I.T., spending alternate terms on various assignments in the G.E. plants at Lynn and Pittsfield. After graduation from M.I.T., he became a member of General Electric's capacitor engineering section in 1929, where he was engaged in development and design of capacitors. In 1931 he was transferred to the transformer division, where he has been connected with the sale of capacitors. In this work he has contacted electric power and industrial companies throughout the country, lecturing to many groups and writing for various trade journals.

▶ J. F. SULLIVAN, JR., formerly superintendent, structural and mechanical division of the Commonwealth Edison Co., Chicago, has been appointed assistant superintendent of construction, to succeed A. P. THOMS, who asked to be relieved of his duties. Mr. Thoms will remain in active service to take care of special assignments. Starting as an inspector in 1925, Mr. Sullivan became a field engineer in 1928 and assistant construction engineer in 1930. He was made superintendent, structural and mechanical division of the Chicago utility in 1936. R. J. HINCH, assistant superintendent, succeeds Mr. Sullivan as superintendent, structural and mechanical division.

▶ DR. ROBERT BEER, for 22 years works manager for the Osram Lamp Works in Vienna, Austria, has joined the engineering department of the Save Electric Corp., Toledo, Ohio. Dr. Beer is one of Europe's leading lamp technicians.

▶ JAMES H. CARMINE of Philadelphia, Pa., has been elected vice-president in charge of merchandising of Philco Corp. Mr. Carmine has been connected with Philco since 1923. His contributions to the company's sales and merchandising activities have played an important part in its growth and expansion into the refrigeration, radio and other industries. After serving in the Pittsburgh, Syracuse, Buffalo, Cleveland and Chicago offices of the company, Mr. Carmine was transferred to the home offices of the corporation in Philadelphia in 1939 to become assistant general sales manager. Last year he was promoted to the position of general sales manager.

# "MEGGER" INSTRUMENTS IN A WORLD AT WAR

In times of peace our "Megger" Insulation and Ground Resistance Testers are used to protect electrical equipment from failure, to insure continuous service and to safeguard human life.

Now, in a world at war, with machines and men at overload production, these vital protective functions of our "Megger" instruments have multiplied to the point where, at the moment, we are somewhat delayed in meeting the urgent needs of both government and industry.

Thus it is that ***"Megger" Testing*** in war time ranks equally in importance with the generators, motors and cables that must be tested and retested ***that they shall not fail.***

If you are so fortunate as to own a "Megger" Insulation Tester—TAKE TIME TO USE IT. Send immediately for our Pocket Manual of "Megger" Practice and other bulletins which contain valuable information on how to make "Megger" tests, with directions for using all types of the "Megger" instruments. Place this literature and your "Megger" instrument in the hands of your best electrician with instructions to find the weak spots in your electrical system.

If your problem is one of ground resistance measurement, send for our Technical Bulletin on that subject. (No charge or obligation for our literature.)

If you need a "Megger" Tester, either temporarily or permanently, ***write, 'phone or wire us.***

**JAMES G. BIDDLE CO.**

**1211-13 Arch Street • Philadelphia, Pa.**

**"MEGGER"**

TRADE MARK REGISTERED U S. PAT OFF

# PAGE FENCE

*America's First Wire Fence — Since 1883*

## GUARDIAN

### OF POWER UNITS ESSENTIAL TO VICTORY

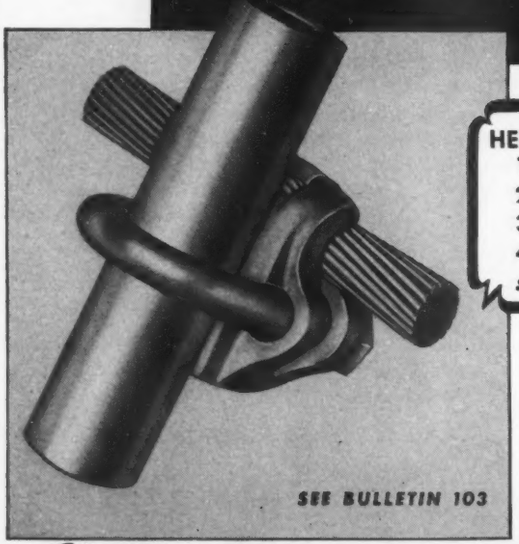
● Production time is now more precious than ever before. Power units must be protected against shut-downs caused by hostile trespassers. Safeguarding power properties has been a major function of sturdy Page Fence since J. Wallace Page originated woven wire fence in 1883, and founded the company which has been a leader in important fence developments. Safeguarding the fence investment through localized, responsible engineering and erecting service is also a Page achievement. More than 100 factory-trained, long-experienced local firms which own their own plants, make up the PAGE FENCE ASSOCIATION, Headquarters: Monessen, Pennsylvania.

**VICTORY FIRST**
*At the Page mills, men, machines and materials are on an all-out schedule for production of fence to protect plants working on Government orders*

PRODUCT OF PAGE STEEL & WIRE DIVISION — AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONN.



# O.Z. GROUND CONNECTORS INSURE POSITIVE GROUND




**HERE ARE 4 REASONS WHY:**
1. Sure Clamping Action
2. Corrosion Resistance
3. Rugged Construction
4. High Conductivity

*SAYS THE WIZARD OF O-Z*

**O.Z. ELECTRICAL MFG. CO.**

262 BOND STREET · BROOKLYN, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

2929


## OBITUARY

### J. C. Kennedy

James C. Kennedy, prominently identified with the public utility industry in the Southwest for a number of years, and president of the Central Power & Light Co., Corpus Christi, Tex., from 1932 to 1939, died on March 9 while on a visit at Bayview, near San Benito. He was 64 years of age.

Indianapolis was Mr. Kennedy's place of birth, but he lived almost his entire life in the South. The first power plant in Gulfport, Miss., was built by Mr. Kennedy for the Gulfport Development Co. Later he engaged in electrical and civil engineering practice in Texas and Mexico, returning to the utility operating field when he became manager of the properties of the Brenham Compress, Oil & Manufacturing Co., the position he held until 1918.

Following World War I he returned to the utility field and in 1923 went to Marshall, Tex., to assemble a large group of properties in East Texas which was known as the East Texas Public Service Co., now the Southwestern Gas & Electric Co. He served as president until 1926.

It was Mr. Kennedy who negotiated

the purchase of Central Power & Light properties for the present owners in 1925 and the following year he became president. A promotion took him to Dallas as president of American Public Service Co. and Central and South West Utilities Co., which was at that time a supervising organization for C. P. & L., as well as other large utility companies in Texas, Louisiana, Oklahoma and Arkansas. From 1926 to 1932 he relinquished the presidency of Central Power & Light, but in 1932 moved to Corpus Christi as president, serving seven years. In 1939 he retired at his own request, remaining on the board of directors until the time of his death.

## J. H. Fiester

John H. Fiester, director of sales and a member of the board of directors of the Kentucky Utilities Co., Lexington, died at the Good Samaritan Hospital in that city on March 23. He was 50 years of age.

Mr. Fiester was associated with the

Edison Electric Appliance Co. at Salt Lake City, Utah, for many years, and prior to joining the Kentucky Utilities Co., in 1935, he was associated with the Electric Bond & Share Co. of New York.

A native of Cripple Creek, Colo., he spent most of his early life at Independence, Iowa, and received his education at Iowa State College, Ames.

•

## Marion Penn

Marion Penn, general manager of the electric department of the Public Service Electric & Gas Co., Newark, N. J., since 1935, died of a cerebral hemorrhage, at his home in South Orange on March 29. He was 51 years of age. Mr. Penn had been connected with the Public Service organization since 1914.

•

▸FRANKLIN A. SNOW, 87, for many years prominent in the underground construction field in New England in connection with power company work, died at Brookline, Mass., on March 19.

▸HUGH MCKNIGHT FERGUSON, research engineer for Utah Power & Light Co. and a member of that organization since 1916, died on February 7, of a cerebral hemorrhage, following a six weeks illness. He was a past-president of the Electrical League of Utah and a former official of the Rocky Mountain Electrical Co-operative League. He was 60 years of age.


Here's An Amazing Performance Story—

80 FOOT-CANDLES of INDIRECT ILLUMINATION USING ONLY 4.9 WATTS PER SQUARE FOOT!

Guth FLU-O-INDIRECT

Trade Mark & Patents Pending

THIS Data on GUTH FLU-O-INDIRECT installation speaks for itself. The Report was written by Mr. J. M. Guillory, Manager Industrial and G&M Sales Division, New Orleans Public Service Inc., and refers to an installation of Indirect Lighting in a Drafting Room working on Defense Production. The installation was made by L. M. Tognini.

"The average intensity as measured with the G. E. Light Meter, with a multiplier, is approximately 80 foot candles. The ceiling-brightness is not objectionably bright and the light-distribution is very uniform. The Draftsmen are highly pleased with the installation and find a complete absence of shadows, no reflected glare and excellent visibility of penciled lines on tracing paper."

**Complete data for the installation is as follows:**

AREA—776 Sq. Ft.
CEILING HEIGHT—10' 6"
MTG. FROM CEIL.—3' 0"
SPACING BETW. ROWS—8' 0"
UNIFORM ILLUMINATION AVERAGE—80 F. C. (after 100 hrs.)
TOTAL No. OF UNITS—16
TYPE UNIT—GUTH M2320
WATTS PER SQ. FT.—4.9
LAMPS USED—100W White

GUTH FLU-O-INDIRECT Luminaires are modern in design. They can be used for individual or continuous installation, requiring only one outlet per unit or run. Write for details.

*The biggest part of GUTH Lighting Equipment is now produced for wartime purposes.*

40th Anniversary of Guth Lighting Leadership

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

# MANUFACTURING-MARKETS

## Allis-Chalmers Net Sales Rose 40%

Allis-Chalmers Manufacturing Co. reported in its recent annual statement to stockholders that 1941 orders booked, wages paid and taxes were the largest in the history of the company.

Net income totaled $5,743,567 after deductions for depreciation, reserves for inventories, interest on debentures and bank loans and all taxes, and equals $3.23 a share on 1,776,092 shares of common stock outstanding, excluding 11,878 shares in treasury. This compares with net profit of $5,051,444, or $2.84 a share, in 1940 after $1,108,052 inventory adjustment.

Provision for federal income and excess profits taxes last year amounted to $8,600,000, compared with $2,518,000 in 1940.

Orders booked reached $187,253,978, or 47 percent above the 1940 total of $127,121,661. Wages and salaries paid increased 43 percent, from $28,670,004 in 1940 to $41,044,673 in 1941. There were 22,168 employees on the company's payroll at the year end, or 5,260 more than the year before.

Net sales billed rose to $121,997,709, from $87,096,966 in 1940, and on December 31, last, unfilled orders stood at $125,011,558, against $59,755,289 a year earlier. Current assets on December 31, 1941, amounted to $81,468,108.

•

## Cates Reports Critical Shortage of Copper

Louis S. Cates, president of the Phelps Dodge Corp., said, while on a recent tour of the company's Arizona properties, that there is a critical shortage of copper and that copper has to be requisitioned for military needs. "The federal government," said Mr. Cates, "is not only collecting copper scrap but requisitioning partially processed copper which had been on its way into the fabrication of consumer goods. For our part we are contributing vast quantities of copper to the supply, producing to the ultimate of capacity, working Saturdays and Sundays and paying the overtime. . . ."

Mr. Cates stated that rationing is a necessity to prevent non-essential use.

•

## Generator Orders Hit New All-Time High

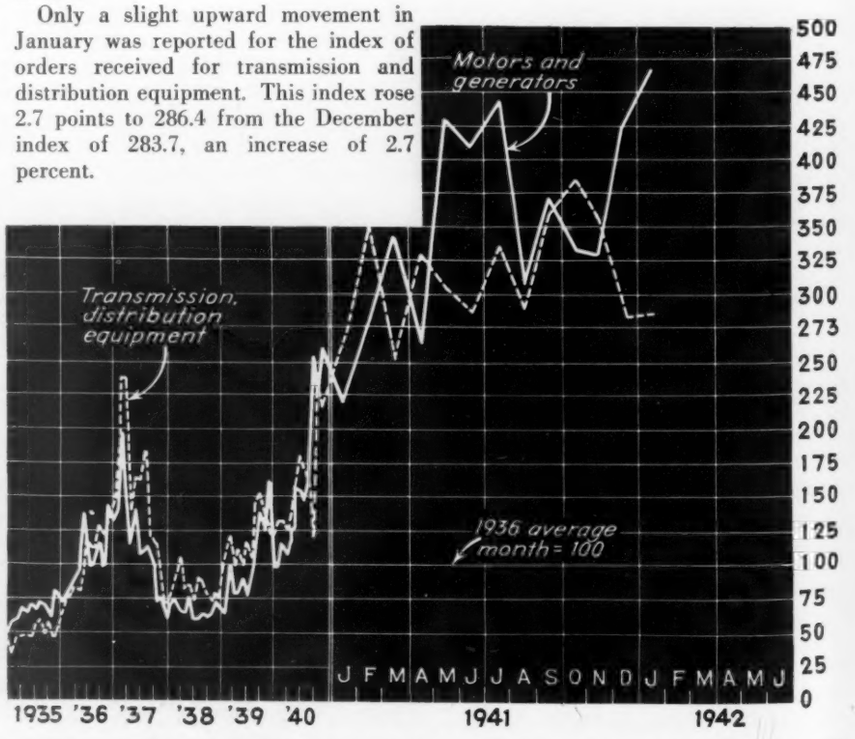
Index of orders received for motors and generators commenced the year by making a new all-time high, advancing 43.6 points to 468.8 from the December index of 425.2, an increase of 10.3 percent. These data were released by the National Electrical Manufacturers Association.

Only a slight upward movement in January was reported for the index of orders received for transmission and distribution equipment. This index rose 2.7 points to 286.4 from the December index of 283.7, an increase of 2.7 percent.

## Residential Motors Enough for Duration

Although war is demanding most of the nation's annual production of 11,000,000 small electric motors which normally go into household equipment, most homes are sufficiently motorized to live comfortably for the duration, according to C. C. Shutt, manager of the Westinghouse Electric & Manufacturing Co.'s small motor division. As many as 20 motor-driven appliances are being used in large numbers of modern homes for washing machines, juice extractors, electric shavers and many other applications.

But the public now finds that the supply of small motors for domestic service is dwindling, since an increas-




**NEMA INDEX, value of orders received for motors (large d.c. polyphase synchronous) and generators (engine, belt-driven); also for transmission and distribution equipment**

ingly larger part of the output of small motors is going into America's war machines, he said. Instead of fractional-horsepower motors for domestic appliances, auxiliary motors for airplanes, tanks, machine tools and other military and industrial duties are being built.

•

## Hygrade Announces New Lighting Process

Announcement has been made of a new manufacturing process perfected by engineers of the Hygrade Sylvania Corp. The new process is said to effect greater initial brilliance in the lamps and to eliminate subsequent development of dark streaks, splotches or shadowy end-bands.

The basis of the new process is the explosion of a mercury "bomb" in the interior of the lamp tube during manufacture, thereby regulating exactly the amount of mercury in the lamp and producing the improved performance claimed for the method.

•

## Knowlson Warns Industry to Follow WPB Orders

J. S. Knowlson, Director of Industry Operations, WPB, has warned business and industry that orders and regulations issued by the War Production Board must be strictly followed.

"Official interpretations of priority orders or regulations," Mr. Knowlson said, "are issued only over the signature of the Director of Industry Operations, the General Counsel of War Production Board, or the Assistant General Counsel for the Division of Industry Operations.

"An explanation of an order, indicating the order's application in a particular case, may be issued by the branch or section chief or other official to whom the administration of the particular order has been assigned.

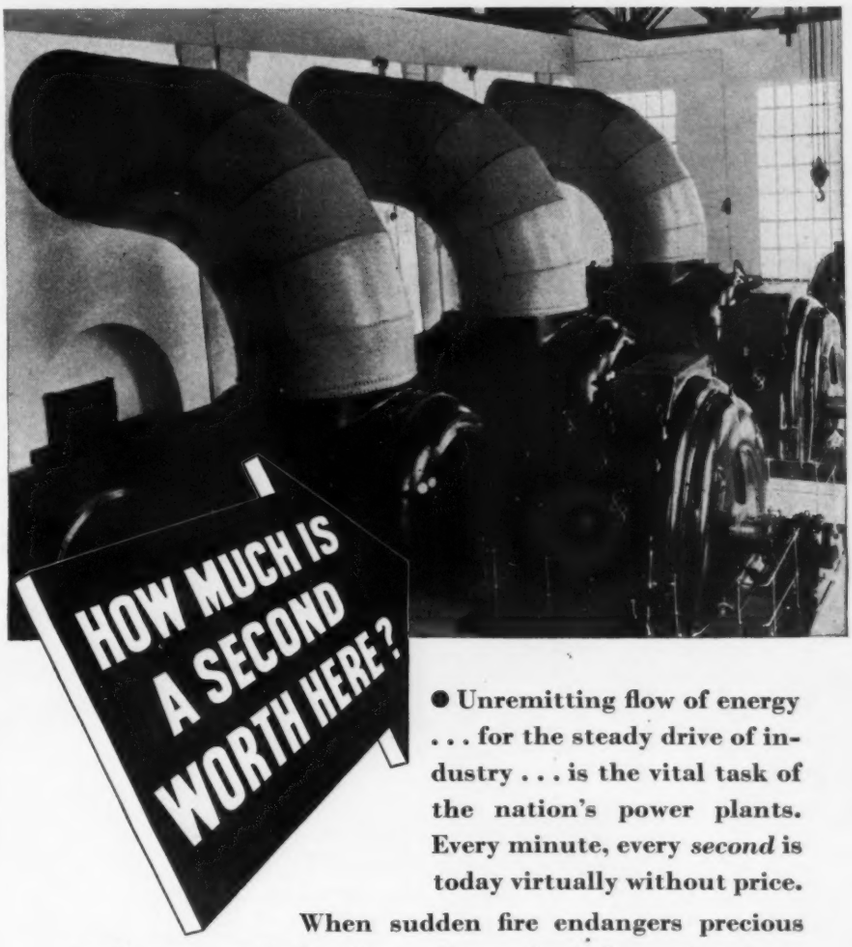
"Interpretations or explanations issued in any manner not in conformity with the above procedure are not official."

•

## Westinghouse Payroll Hits New Record High

Reflecting accelerated war production, an all-time record number of employees at the Westinghouse Electric & Manufacturing Co. received in January this year the largest monthly payroll in the company's history. January's payroll amounted to $19,061,581, more than $2,000,000 higher than any previous month. The number of employees reached a new high.


BOMBS OR SABOTEURS MAY NEVER REACH YOU... BUT ARE YOU *Ready?*




● **Unremitting flow of energy . . . for the steady drive of industry . . . is the vital task of the nation's power plants. Every minute, every *second* is today virtually without price.**

**When sudden fire endangers precious equipment and the lives of experienced employes . . . when it threatens to halt the steady flow of power, *split-second speed* is all important.**

**DuGas provides that speed. A safe non-conductor, duGas is particularly effective on fires in electrical equipment and fires involving highly inflammable oils and gases. DuGas kills hazardous fires in seconds. DuGas cuts priceless time from the extinguishing period.**

*Names on Request . . . of utilities where duGas stands on guard.*

duGas

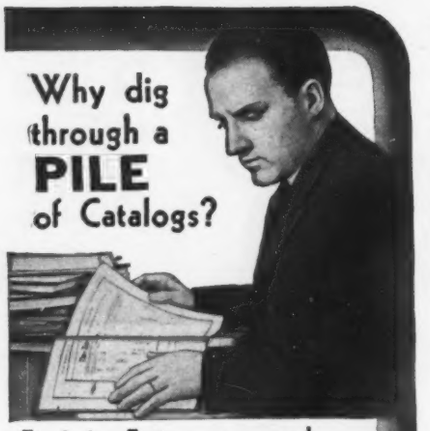
# Fire Extinguishing Apparatus

**DUGAS ENGINEERING CORPORATION • MARINETTE, WISCONSIN**

*Owned and Operated by* ANSUL CHEMICAL COMPANY

Represented in Principal Cities

DUGAS FIRE EXTINGUISHING APPARATUS IS APPROVED BY UNDERWRITERS' LABORATORIES, FACTORY MUTUAL LABORATORIES

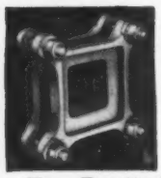



Find the Fitting you need—quickly—in the COMPLETE line

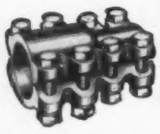
If you have a Penn-Union Catalog, you can instantly find practically every good type of conductor fitting. These few can only suggest the variety:

**Universal Clamps** to take a large range of conductor sizes; with 1, 2, 3, 4 or more bolts.

**L-M Elbows,** with compression units giving a dependable grip on both conductors. Also Straight Connectors and Tees with same contact units.



**Bus Bar Clamps** for installation without drilling bus. Single and multiple. Also bus supports — various types.



**Clamp Type Straight Connectors and Reducers, Elbows, Tees, Terminals, Stud Connectors, etc.**

**Jack-Knife connectors** for simple and easy disconnection of motor leads, etc. Spring action — self locking.

**Vi-Tite Terminals** for quick installation and easy taping. Also sleeve type terminals, screw type, shrink fit, etc. etc.

**Splicing Sleeves,** Figure 8 and Oval, seamless tubing—also split tinned sleeves. High conductivity copper; close dimensions.

**Preferred** by utilities, industrials, electrical manufacturers, contractors — because *they have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*

**PENN-UNION ELECTRIC CORPORATION**
**ERIE, PA.** *Sold by Leading Jobbers*

**PENN-UNION**
Conductor Fittings


# Field Reports on Business

*Business continues to move along at a fast pace. Electrical manufacturers report a heavy demand for a wide variety of equipment. Higher income taxes and defense bonds sales have not curbed retail sales activity, with pre-Easter trade more than 25 percent over last year*

## NEW ENGLAND

Stepping up war production has increased power equipment sales during the first quarter of 1942. A large amount of factory space formerly for sale in the real estate market has been taken over either for plant expansion or for storage, resulting in encouraging sales of small motors, panelboard apparatus and factory lighting supplies. United Aircraft Corp. has announced plans for three new branch plants in Willimantic and Southington, Conn., and in East Longmeadow, Mass., totaling approximately $15,000,000 in cost. It is expected that the East Longmeadow plant will be completed and equipped for production next fall.

Industrial electric heating is active. Twenty-one 60-kw. water heaters are being built by the Commonwealth Electric Manufacturing Co., Boston, for Pennsylvania installations. A Massachusetts war material plant has purchased 700 kw. in electric heat-treating equipment. Manufacturers of arc welders report strong demands for their units.

New England Public Service groups in Maine, New Hampshire and Vermont built 573 miles of rural extensions in 1941, costing about $852,000 and serving 2,101 new customers. Electrical merchandise sales totaled $3,414,930, a gain of 37.2 percent over 1940, but these sales have been decreasing, largely because of inability to obtain household appliances. Connecticut Power Co. added 1,451 domestic electric ranges to its lines in 1941 and now has 11,939 in operation. Vermont central station appliance sales show a wide margin of gain over 1941 to date.

A contract for facilities at the Newport, R. I., Naval Station has been awarded to Ford, Bacon & Davis, New York, at a cost of $1,453,145.

## PACIFIC COAST

Mounting priorities and merchandising restrictions are naturally hampering business, but in general wholesalers report a first quarter which improved somewhat on the last quarter of 1941. California Central Valley project has been affected by the cut in Reclamation Department projects, one elimination being the proposed Antioch steam plant. Flood control and irrigation will undoubtedly be this project's chief concern. A new crop of airports has reached the lighting stage of construction, the average equipment begin on the scale of 80 boundary lights and the average lighting installation costing $30,000.

Bonneville system officials have recommended construction of a 100,000-kw. plant, costing $15,000,000, at Clark's Ford near Cabinet, Idaho; the government is investigating a site for the proposed power plant on the Trinity River in northwestern California; and San Francisco is considering a June bond issue of $4,000,000 for fire and pumping equipment.

Orders of varied interest cover ten 36,000-kva. Westinghouse transformers costing $822,610 for Grand Coulee; $87,802 of steel towers and $25,756 Westinghouse switch gear for Los Angeles; a Gamewell fire alarm system for the Keyport, Wash., shipyard, and $46,280 G.E. transformers for Boulder City. A low bid of $208,417 is recorded for constructing the 35-mile, two-circuit transmission line from Nisqually River to Tacoma; the Bonneville system has bought four 1,667-kva. Pennsylvania transformers for $37,996; G.E. circuit breakers costing $958,395 for five substations; $87,842 of Bethlehem steel of 115-kv. superstructure for main power house, and $112,300 of suspension insulators.

## NEW YORK

In spite of the effects of plant conversions and other disturbances incident to the war program, general business activity seems to have been maintained at or near peak levels. Industrial activity is expected to accelerate markedly during April as a large number of new war plants go into operation.

Engineering construction volume last week, $177,115,000, topped the corresponding 1941 week's total by 40 percent, but was 35 percent lower than the near record volume of the preceding week, according to *Engineering News-Record.* The week's construction brought 1942 volume to $1,993,088,000, a gain of 36 percent over the $1,461,248,000 reported for the thirteen-week period last year.

Department store executives in the metropolitan area estimate that the volume of sales is running at better than 25 percent ahead of a year ago.

## CHICAGO

Business continues to move along at a faster pace as the swing to production of war materials gains additional momentum each week. Plans to broaden the scope of the war program and at the same time aid the "little fellow" are becoming more effective, with the result that hundreds of small factories and machine shops are now receiving contracts for the first time.

Industrial wage payments in Illinois during February were at record levels as employment and payrolls increased slightly over January. However, employment and payrolls in retail establishments and nonmanufacturing industries declined.

Electrical manufacturers report a record demand for a wide variety of equipment. The Chicago office of General Electric Co. is reported booking orders for industrial equipment at the rate of approximately $1,000,000 per month. Orders for motors, switchgear and control apparatus are especially heavy. Belden Manufacturing Co. reports orders booked for wire during March exceed any previous month in the firm's history. Federal Electric Co. shows sales at high level with 85 percent of the total output devoted to war materials. Borg-Warner Corp. reports unfilled orders for war items totaling $137,000,000 on March 15. Only 7 percent of the company's March production was for civilian consumption and that is rapidly being converted to war production.

Definite plans were announced for the construction of an aluminum rolling mill in the Chicago area for the Aluminum Co. of America at a cost of approximately $50,000,000. Electric power requirements for the plant are estimated at between 30,000 and 50,000 kw.

# INDUSTRY ANSWERS THE CALL!

A WAR MESSAGE
to
ALL EMPLOYERS
★ From the United States Treasury Department ★
WHAT THE PAY-ROLL SAVINGS PLAN DOES
A PAY-ROLL SAVINGS PLAN
To get full facts on installing the Pay-Roll Savings Plan, write TODAY to Treasury Department, Section B, 709 12th Street, N.W., Washington, D. C.
U. S. Defense BONDS ★ STAMPS
This space contributed to National Defense by
YOUR NAME HERE

## 32,145 Firms With Over 17,700,000 Employees Have Installed the . . .

## PAY-ROLL SAVINGS PLAN

## *Have YOU Started the Pay-Roll Savings Plan in YOUR Company?*

**Like a strong, healthy wind, the Pay-Roll Savings Plan is sweeping America! Already more than 32,000 firms, large and small, have adopted the Plan, with a total of over seventeen million employees—and the number is swelling hourly.**

***But time is short!*. .More and more billions are needed, and needed fast, to help buy the guns, tanks, planes, and ships America's fighting forces *must* have. The best and quickest way to raise this money is by giving *every* American wage earner a chance to participate in the regular, systematic purchase of Defense Bonds. The Plan provides the one perfect means of sluicing a part of ALL America's income into the Defense Bond channel regularly every pay-day in an ever-rising flood.**

**Do *your* part by installing the Pay-Roll Savings Plan *now*. For truly, in this war, this *people's* war, VICTORY BEGINS AT THE PAY WINDOW.**

### Plan Easy to Install

**Like all efficient systems, the Pay-Roll Savings Plan is amazingly easy to install, whether your employees number three or ten thousand.**

**For full facts and samples of free literature, send the coupon below—today! Or write, Treasury Department, Section C, 709 Twelfth Street NW., Washington, D. C.**

### MAIL THIS COUPON NOW

Treasury Department, Section C
709–12th St., NW.
Washington, D. C.

We want to do our part. Please rush full information regarding the Pay-Roll Savings Plan.

NAME .....

POSITION .....

COMPANY NAME .....

ADDRESS .....

NUMBER OF EMPLOYEES .....

*MAKE EVERY PAY-DAY . . . BOND DAY!*

**U. S. Defense BONDS ★ STAMPS**

This space is a contribution to NATIONAL DEFENSE by Electrical World

GPO 16—20944-1 Form No. DSS-280

# MAILING LISTS THAT WORK...

McGraw-Hill Industrial Mailing Lists are a direct route to today's purchase-controlling executives and technicians in practically every major industry.

These names are of particular value now when most manufacturers are experiencing constantly increasing difficulty in maintaining their own lists.

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled changes in industrial personnel. These lists are compiled from exclusive sources, based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff, and are maintained on a twenty-four hour basis.

Investigate their tremendous possibilities in relation to your own product or service. Your specifications are our guide in recommending the particular McGraw-Hill lists that best cover your market. When planning your industrial advertising and sales promotional activities, ask for more facts or, better still, write today. No obligation, of course.

**McGraw-Hill Publishing Co., Inc.**
*DIRECT MAIL DIVISION*
330 West 42nd Street New York, N. Y.


## Manufacturers Issue Earnings Reports

Net profit statements covering 1941 have been issued by several electrical manufacturing companies. Among the reports recently issued are the following:

WESTON ELECTRICAL INSTRUMENT — Including subsidiary, net profit $937,638, exclusive of reserve for post-war adjustments, equal to $5.84 each on 160,583 shares, excluding 3,417 shares held in treasury. After deducting $200,000 reserve for post-war adjustments, balance of $737,638 was transferred to earned surplus. This compares with 1940 net profit of $735,842 or $4.57 a share after $25,000 provision for contingencies.

MINNEAPOLIS-HONEYWELL REGULATOR—Net income, after $500,000 contingency reserve, $2,737,295, equal, after preferred dividends, to $4.20 each on 621,900 shares of common stock outstanding, against 1940 net income of $2,528,602, or $3.87 a share; sales, $24,257,811, compared with $15,993,565.

CLARK CONTROLLER — Net profit, $640,942, equal to $4.08 a share on outstanding stock, compared with $374,449, or $2.38 a share in 1940.

CANADIAN GENERAL ELECTRIC—Net income, $2,479,556, equal, after dividends on the preference stock, to $12.60 on each common share outstanding. This compares with a net of $2,308,019, or $11.71 on each common share, after preferred dividends in 1940. Current assets totaled $28,620,817 and current liabilities were $11,423,016, leaving working capital of $17,197,801, compared with $16,126,608 at the end of 1940.

•

## Blackout Caps Shield Transformer Signal Lamps

Tiny helmet-like blackout caps to shield the red glow of 5-watt signal lamps on pole-mounted distribution transformers from possible enemy bombers have been rushed to the West Coast by airplane and are now being installed in a number of American cities, according to H. V. Putman, manager of the Westinghouse Electric & Manufacturing Co.'s transformer division.

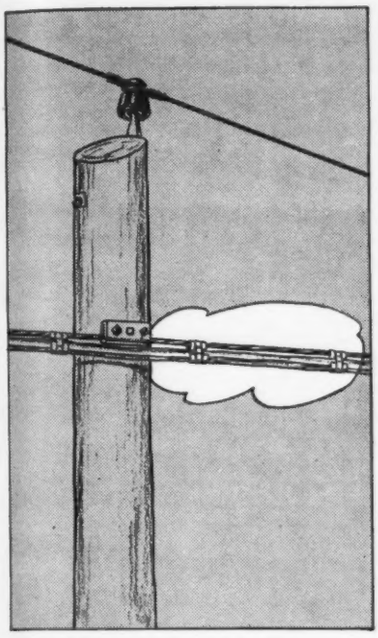
Shaped like a deep-sea diver's helmet and a little smaller than a golf ball, the caps snap over the red lights which flash on when transformers are in danger of becoming overheated. A small hole in one side of the cap lets a narrow beam of light shine downward to guide electric service men, but no light can be seen from above, it was explained.

•

## Southwest Power Survey

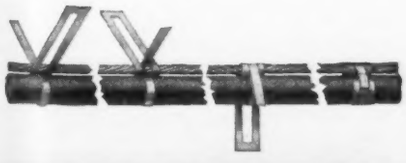
Surveys of the power situation in the Southwest are being made by utilities commissions of Arkansas, Nebraska, Kansas, Missouri and Oklahoma.

# Reduce Outages Avoid Cable Wear Reduce Maintenance



## RELIABLE CABLE HANGERS

prolong life of cables and conserve strategic materials by eliminating wear on cable sheaths or on insulation of hand made cables. Reliable cable hangers hold cable and messenger together tightly with wide bearing surfaces which eliminate snaking and chafing. They are easily applied and make installations that are permanent and very neat



Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE · CHICAGO ILLINOIS


## Manufacturers Make Sales Assignments

Struthers Dunn, Inc., Philadelphia, Pa., has announced the appointment of the John W. Clarke Co., 327 S. LaSalle Street, Chicago, as sales and engineering representatives of Dunco relays and timing devices in that territory. Special attention will be given by the Clarke organization to the heavy demand for relays and timers for war equipment purposes to which a large percentage of Dunco production is now devoted. The Clarke territory for Struthers Dunn, Inc., includes the state of Wisconsin, the upper peninsula of Michigan, northern Illinois, Chicago and the neighboring counties of Indiana and the eastern border counties of Iowa.

Other companies recently announcing sales appointments include:

Ilg Electric Ventilating Co., Chicago, has appointed Byron L. Casey of the Chicago City sales office district manager of the northern territory, supervising branch offices in Chicago, Milwaukee, Minneapolis, Galesburg and South Bend. Wallace G. Burbo has been appointed manager of the Boston branch office. Charles E. Parks, formerly manager of the Pittsburgh branch office, has been transferred to Los Angeles, where he will assume new duties as district manager of the Pacific Coast territory. Branch offices in Los Angeles, San Francisco, Seattle, Salt Lake City, San Diego, Phoenix and El Paso will be under his supervision. Charles H. Schneider, formerly in the Philadelphia branch office, assumes the position vacated by Mr. Parks as manager of the Pittsburgh branch office. The Pittsburgh office now becomes a part of the Middle Atlantic territory, under the supervision of C. W. Smith at Philadelphia. In Houston, Tex., W. M. Vernor has been placed in charge of the Ilg branch office under the jurisdiction of Joseph J. Friedler, manager of the southern territory.

Sawyer Electrical Manufacturing Co., Los Angeles, has appointed George M. Snodgrass manager of its eastern sales division, with headquarters at 2110 Terminal Tower, Cleveland, Ohio. The Sawyer company manufactures a line of special electric motors for machine tools, rotor and stators for built-in applications, electric grinders, sanders, buffers and blowers.

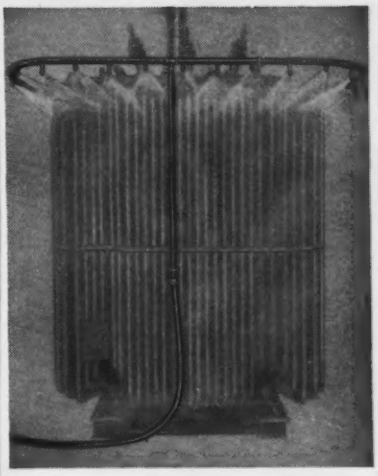
Graybar Electric Co. has announced the appointment of W. E. Mallicote, formerly salesman at the Knoxville branch of the company, to the position of sales manager of the Chattanooga office. He replaces C. C. McGraw, who has been called into the service.

•

## Urge Use of Forms PD-1A

Persons seeking to obtain preference ratings in order to purchase air conditioning or commercial refrigeration equipment have been urged by the Air Conditioning and Commercial Refrigeration Branch to submit in detail all the information called for on application forms PD-1A.


# THE BROOKS SPRAY RING



# TRANSFORMER COOLING

***Get more capacity from your present power transformers.***

The heavy loads demanded by industry today place extremely heavy burdens on your power transformers. Equipped with Brooks Spray Rings transformers are delivering 60% or more over rated capacity without injury by overheating.

***Easy to Install and Operate***

Header ring of 1¼" heavy copper tubing, bent to fit transformer, is mounted on iron brackets set out from cooling tubes far enough to clear sling hooks.

The ninety degree sprayer nozzles placed at about 1 foot intervals, are swiveled so that every spray is directed at the crown of the cooler tubes with overlap for efficient cooling of all tubes and tank wall.

Ordinary hose supply of 15 to 20 gallons per minute is ample. Automatic operation also possible.

**BROOKS SPRAY RING FEATURES**

*Low Cost*
*Frost Proof*
*Self Draining*
*Easy to Install*
*Simple to Operate*
*Highly Efficient*

***WRITE for complete details and prices***

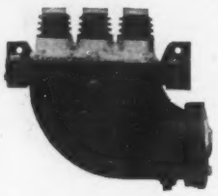
**JOHN A. BROOKS SPRINKLING SYSTEMS**
20122 LIVERNOIS AVE.
**DETROIT, MICH.**
*Patented Sprinkling Devices Since 1915*

**ELECTRICAL SPECIALTIES**

**FOR HEAVY DUTY**

**POWER SERVICE**

RMC



For over a quarter of a century, Rusgreen has been making Potheads and special items, built to the most exacting requirements. Bring your electrical problems to Rusgreen . . . today!

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

**RUSGREEN MFG. CO.**

14260 Birwood Avenue • Detroit, Mich.



**A WATCHMAN WHO NEVER SLEEPS**

Stewart Non-Climbable Chain Link Wire Fences provide unfailing protection against unwarranted trespass. Don't take chances —you need Stewart protection NOW! Write, wire or phone Hemlock 1985. Catalog I-41 will be sent on request. Stewart maintains sales and erection offices in all principal cities.

**The Stewart Iron Works Co., Inc.**
966 Stewart Block Cincinnati, Ohio
"Fence Builders to America Since 1886"

Stewart IRON and WIRE FENCES



**Your next engineering or business project...**

**WILL IT PAY?**

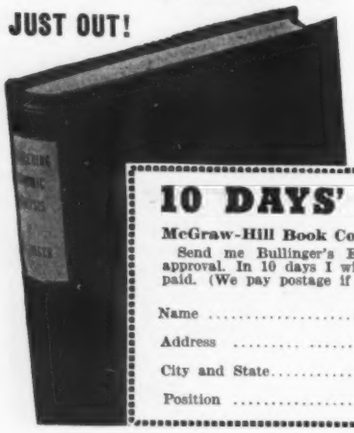
The complete, three-fold method of analysis you need in order to find out most accurately is described in detail in this book.

**THIS NEW BOOK TELLS YOU**

how to analyze a projected venture from the standpoint of:—

- *evaluating the economic factors and getting estimated costs*
- *separating and defining the intangible factors*
- *determining the financial problems involved and methods of handling them*

**JUST OUT!**



**Engineering Economic Analysis**

By C. E. Bullinger, Professor of Industrial Engineering, Pennsylvania State College. 359 pages, 6x9, 75 illustrations, $3.50.

PRESENTS in considerable detail the methods of economic analysis of engineering projects for the purpose of determining whether or not they are financially feasible. Beginning with the "idea" stage, the book covers every step in the development of a project, showing the economic and intangible factors that must be dealt with, methods of finding costs, and how to summarize the financing problems involved. The use of charts is stressed as a means of analysis.

**10 DAYS' FREE EXAMINATION**

McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York

Send me Bullinger's Engineering Economic Analysis for 10 days' examination on approval. In 10 days I will send you $3.50 plus few cents postage or return book postpaid. (We pay postage if you remit with order.)

Name .....

Address .....

City and State .....

Position .....Company .....W.4-4-42


## Sales Opportunities

NEW IBERIA, LA.—Gulf Public Service Co., New Iberia, plans expansion and improvements in local generating station, including installation of new 1,000-kw. generator unit and accessories. Also will make extensions in primary and secondary lines in vicinity of city.

EAU CLAIRE, WIS.—Northern States Power Co. of Wisconsin, Eau Claire, plans new power substation near Camp McCoy, vicinity of Eau Claire, for power supply for federal cantonment at that place. Work will include extensions in transmission lines in same district for connection with new station. Proposed to begin work soon.

MOUNT PLEASANT, UTAH—Municipal Light and Power Department plans extensions and improvements in primary and secondary lines, including additional service connections in different parts of city. Bond issue is being arranged for this and proposed expansion in water system, both projects to be carried out at same time.

SHELDON, IOWA—Iowa Public Service Co., Sioux City, Iowa, plans expansion and improvements in generating station at Sheldon, including installation of new diesel engine-driven electric generator and auxiliary equipment. Proposed to begin work soon. Also will make extensions and improvements in primary and secondary lines at Sheldon and vicinity.

PITTSBURGH, PA. — Allegheny Ludlum Steel Corp., Oliver Building, Pittsburgh, manufacturer of stainless and tool steels, etc., plans installation of motor-generator sets, motors and controls, switchgear and accessories, regulators, electric conduits, power wiring, industrial lighting system, electric cranes, hoists, conveyors and other equipment in new mill for production for government, exact location withheld. It will comprise several large one and multi-story production units, with group of auxiliary buildings for storage, distribution and auxiliary service. A power substation is planned. Entire project will cost about $4,600,000, with financing to be provided by Defense Plant Corporation, Washington, D. C., a federal agency. Work is scheduled to begin at early date.

VERSAILLES, KY.—East Kentucky Rural Electric Co-operative Corp., recently organized, William C. Dale, Shelbyville, Ky., company official in charge, has plans maturing for new steam-electric generating station, for which site has been secured on Kentucky River in Woodford County, vicinity of Versailles. Plant will be used for power supply in group of over 50 counties in eastern part of state, including service for a number of rural electric distribution cooperatives in different districts. Cost estimated close to $3,000,000, including transmission lines, power substations and other operating structures. Financing will be secured through federal aid. P. M. Sullivan, Gallatin, Tenn., is consulting engineer.

CHAMPAIGN, ILL. — Illinois-Iowa Power Co., Monticello, Ill., plans extensions in primary and secondary lines in parts of Champaign and neighboring counties, totaling close to 50 miles, for expansion in rural electric system, including service facilities.

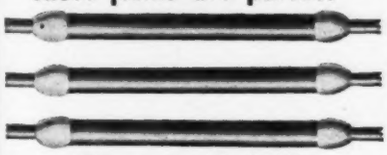
OCONTO FALLS, WIS.—Wisconsin-Michigan Power Co., Appleton, Wis., has tentative plans for new power substation in

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

**INDIANA STEEL & WIRE CO.**
MUNCIE, INDIANA

**LOOK!**
**These joints are perfect**



They were wiped with
**"WILLIAMS"**
**PREPARED—READY FOR USE.**
**Wiping-Cloths**
Write for Literature and Prices

**GEO. E. WILLIAMS, Mfr.**
3035 Aldrich Avenue Minneapolis, Minn.

**Permanent Property Marking**

For Public Utilities is provided by Premax Metal Markers and Tags. Easy to install—unnecessary to replace.

**Premax Products**
division of Chapman Packing Co., Inc.
4211 Highland Avenue
NIAGARA FALLS, N. Y.

*Send For Samples and Specifications*


vicinity of Oconto Falls, for increased power distribution in that area. New station unit will be connected with transmission line from Oconto Falls hydroelectric generating station of company.

FORT WAYNE, IND.—Studebaker Corp., Aviation Division, South Bend, Ind., manufacturer of airplanes and parts, plans installation of motors and controls, transformers and accessories, switchgear, fluorescent lighting system, electric conduits, power wiring, conveyors and other equipment in new plant at Fort Wayne for production for government. It will comprise a main one and multi-story unit, with auxiliary buildings. A substation is planned for main power service for plant. Entire project is reported to cost over $1,500,000, with financing to be provided by Defense Plant Corporation, Washington, D. C., a federal agency. Giffels & Vallet, Inc., Marquette Building, Detroit, Mich., is architect and engineer.

YORK, NEB.—York County Rural Public Power District, York, plans extensions in primary and secondary lines in parts of York and Seward Counties, for expansion in rural electric system, including service facilities. Permission has been secured and work is scheduled to begin soon.

NEW YORK, N. Y.—National Aniline Defense Corp., recently organized subsidiary of National Aniline & Chemical Co., 40 Rector Street, a unit of Allied Chemical & Dye Corp., 61 Broadway, plans installation of motors and controls, switchgear, transformers and accessories, regulators, fluorescent lighting system, conduit system, power wiring and other equipment in new plant in northern New York, exact location withheld, for chemical production for government. It will consist of several large manufacturing units, reported to cost in excess of $5,000,000. Financing will be provided by Defense Plant Corporation, Washington, D. C., a federal agency. Work will begin at early date.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, receives bids until April 14 for 22 electric arc welding sets and spare parts for Sewall's Point, Va., yard, and 15 similar welding sets for Mare Island navy yard, mentioned (Schedule 768); and until April 17 for 150 transformers for welding service, with accessory apparatus, for Boston, Mass., and Mare Island yards (Schedule 760).

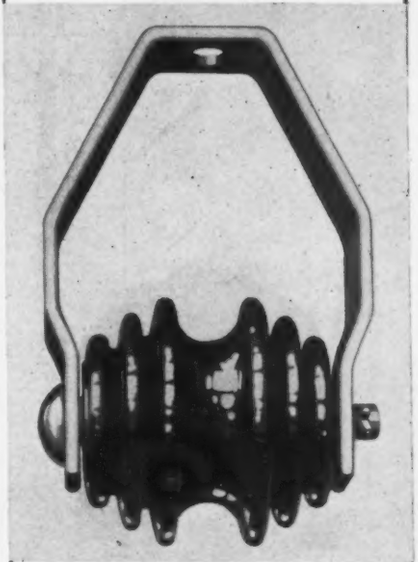
ERIE, PA.—Erie Forge & Steel Co., West Sixteenth Street, manufacturer of steel forgings, castings, grinding rolls, etc., plans installation of motors and controls, transformers and accessories, switchgear, electric conduits, power wiring, conveyors and other equipment in new additions to plant for production for government. Entire project will be carried out during a period of months and is reported to cost close to $1,000,000.

•

## Reliance Gets Navy "E"

Reliance Electric & Engineering Co. has been awarded the Navy "E" pennant and its employees have been presented with "Navy E" pins for 'work well done" on Navy production. Rear Admiral William C. Watts, U.S.N. (retired), made the presentation.


**THOMAS**
**Dead End Clevis Strain**
**INSULATORS**



No. 13207

| | |
|---|---|
| DRY FLASHOVER | 36 kv. |
| WET FLASHOVER | 25 kv. |
| ULTIMATE STRENGTH | 6,000 lbs. |

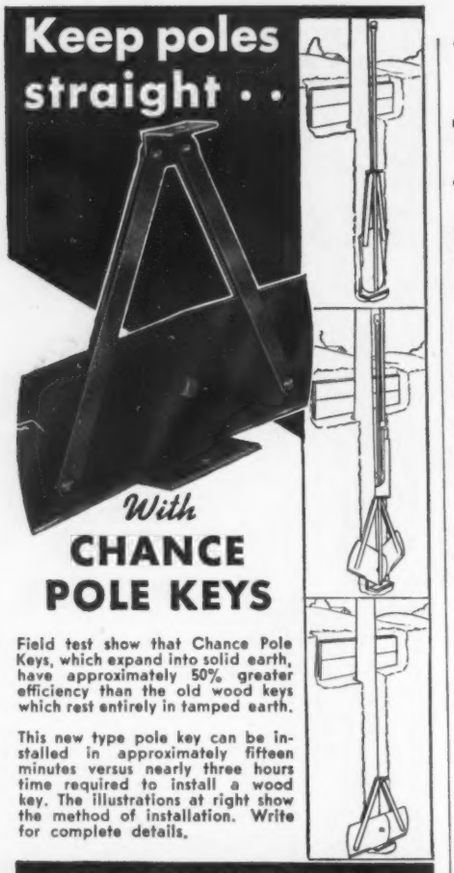
**SPECIFY THOMAS**
for these plus values—at no extra cost.

- Porcelain is wet-process, the same rugged high quality we use for all high voltage insulators. Grooves are spacious, well rounded and covered with smooth glaze.
- Tapered hole in the spool equalizes mechanical load on the porcelain and prevents breakage under unusual or severe stress.
- Steel fittings are smoothly and uniformly hot dipped galvanized.
- A wide choice of types and sizes is offered for all distribution voltages. All are of highest quality production and designed for long life and dependable performance.

Write for catalog illustrating complete line.

THE R. THOMAS & SONS CO.
LISBON · OHIO

Keep poles straight . .



With CHANCE POLE KEYS

Field test show that Chance Pole Keys, which expand into solid earth, have approximately 50% greater efficiency than the old wood keys which rest entirely in tamped earth.

This new type pole key can be installed in approximately fifteen minutes versus nearly three hours time required to install a wood key. The illustrations at right show the method of installation. Write for complete details.

A·B·CHANCE CO·
CENTRALIA MISSOURI

ILSCO
SOLDERLESS CONNECTORS
HAVE YOU TRIED
The New Ilsco Lugs?

BUILT FOR OVERLOADS!

The new design—as passed by the Underwriters' Laboratories May 1, 1940.

MAIL COUPON TODAY

GENTLEMEN:
SEND ME new Catalog & Sample!

Name .....
Firm .....
Address .....
City & State .....

ILSCO COPPER TUBE AND PRODUCTS, INC.
2979 MADISON ROAD — CIN., O.

# LETTER TO THE EDITOR

## Stranded, Not Solid

*To the Editor of* ELECTRICAL WORLD:

In your February 7, 1942, issue of ELECTRICAL WORLD a short article which I prepared, entitled "Capacitors for Higher Line Thermal Loading," was published. One set of curves in this article gave the temperature rise for ACSR at 60 cycles in still air. The smaller sizes of conductor were listed incorrectly in the curves as solid. These data apply for stranded cable and I believe it should be called to the attention of your readers.

J. W. BUTLER,
Central Station Engineering Dept.,
General Electric Company,
Schenectady, N. Y.

•

## Lincoln Electric Moves Six Branch Offices

Lincoln Electric Co., Cleveland, Ohio, has announced new addresses for six of its offices.

Oklahoma City office is now located at 19 North Ellison St. R. L. Looney, manager, will be in charge. The new location of the Milwaukee office is at 733 North Van Buren Street. F. C. Archer continues as district manager. R. M. Daniels is in charge of the Chattanooga office, now located at 1111 James Building. The Chicago office is now located at 323–325 East 23d Street and G. E. Tenney continues as manager. Fuchs Machinery & Supply Co., the Lincoln office in Omaha, has been moved to 521 South Fifteenth Street. The new address of the Dayton office is 246 Wiltshire Boulevard and R. P. Sharer, manager, is in charge.

•

## Equipment Contracts Let

Municipal Water, Light and Traction Department, Monroe, La., has awarded contracts for equipment for municipal power station, where an expansion program will be carried out. The expansion program includes a 6,000-kw. turbine-generator unit and accessories ordered from Westinghouse Electric & Manufacturing Co., price $137,974; two condensers, C. H. Wheeler Manufacturing Co., $47,900, and switchgear, General Electric Co., $65,964.

BOLTS FOR YOU . . . Mr. War Manufacturer

Where priorities will allow, Harper can ship non-ferrous, Monel and stainless fastenings. You can "join the Navy" and manufacturers of panels, gauges, instruments and scores of other items for Offense, now using Harper products

4320 STOCK ITEMS

. . . of non-ferrous, Monel and stainless bolts, nuts, screws, washers, rivets and related items offer a wide choice and reduce necessity of making specials. WRITE FOR CATALOG and reference book—four colors, 80 pages. Harper products now available only to war and most essential industries.

THE H. M. HARPER CO.
2611 Fletcher Street
Chicago, Illinois

HARPER Chicago

•

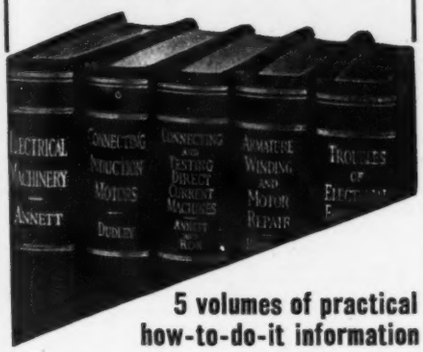
*Don't Forget*

The AMERICAN RED CROSS

*Give Today*

•

## Every phase of electrical maintenance and repair work covered in this Library




**5 volumes of practical how-to-do-it information**

**Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.**

## Electrical Maintenance and Repair Library

**2042 pages, 1721 illustrations and diagrams**

***These books show you how to***

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench of a Wheatstone bridge.

***New trouble-shooting book***

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

**10 days' examination**
**Easy monthly payments**

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

**EXAMINATION COUPON**

McGraw-Hill Book Co., Inc.
330 W. 42nd St., New York, N. Y.

Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

Signature .....
Address .....
City and State .....
Firm or Employer .....
Position .....W. 4-4-42


## New Allotments Announced by REA

Allotments of $1,259,500 have recently been announced by Rural Electrification Administrator Harry E. Slattery. These allotments bring the total to $444,675,744, of which $75,977,700 represents operations during the current fiscal year.

In making these allotments Mr. Slattery repeated the statements that no new construction will be undertaken except in accordance with authorization or regulations of the War Production Board, and in the case of allotments involving acquisition of existing properties the funds allotted for new construction will not be used until the war is over.

Details are as follows:

ARKANSAS—Ozarks Rural Electric Coop. Corp., Fayetteville, E. H. Looney, mgr., $35,000 to complete a section of the system.

COLORADO—LaPlata Electric Assn., Durango, $125,000 for the acquisition of distribution systems in villages of Bayfield and Ignacio and transmission line serving Ute Agency; also construction of 81 miles of line, 407 members in LaPlata and Archuleta counties. San Miguel Power Assn., Inc., Nucla, Paul H. Linden, supt., $74,000 to acquire facilities in village of Norwood and to build 74.5 miles of line, 352 members. Mountain View Electric Assn., Inc., Colorado Springs, $580,000 to acquire and rehabilitate 143 miles of transmission and distribution line and to build 500 miles of line, 2,224 members.

FLORIDA—Peace River Valley Electric Membership Cooperative, Inc., Wauchula, Charles E. Crow, supt., $92,000 to complete a section of the system and provide for construction of 55 miles, 125 members.

IDAHO—Long Valley Power Cooperative, Inc., Donnelly, Ed. A. Tull, supt., $125,000 to complete a section of the system and acquire distribution lines in Valley County; $62,000 for acquisition and rehabilitation of generating facilities.

MISSOURI—Ralls County Electric Coop. Assn., New London, E. J. Elledge, supt., $54,000 to acquire an existing system in town of Stoutsville and to build 57 miles of line, 170 members.

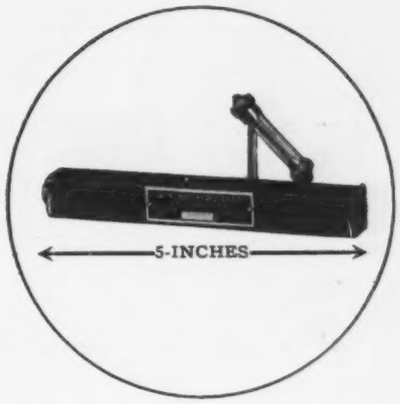
SOUTH CAROLINA—Horry Electric Cooperative, Inc., Conway, Lloyd P. Williams, $34,500 to complete a section of the system.

TEXAS—Panola-Harrison Electric Cooperative, Inc., Elysian Fields, Otto Wood, mgr., $25,000 to complete a section of the system. Fannin County Electric Coop., Inc., Bonham, Alonzo Chaffin, supt., $16,000 to provide office headquarters building. San Bernard Electric Cooperative, Inc., Columbus, $12,000 to provide office headquarters building. Wharton County Electric Cooperative, Inc., El Campo, $10,000 to complete a section of the system. Tri-County Electric Cooperative, Inc., Azle, $15,000 to complete a section of the system.

•

## Gets Navy "E" Banner

Electric Storage Battery Co., Philadelphia, Pa., has received the Navy "E" banner for excellence.


### No Fallacious Guesses.

There is no guessing with a Matthews Teleheight. Any lineman can be taught to use it and get any height within an inch or so. He can learn in five minutes.

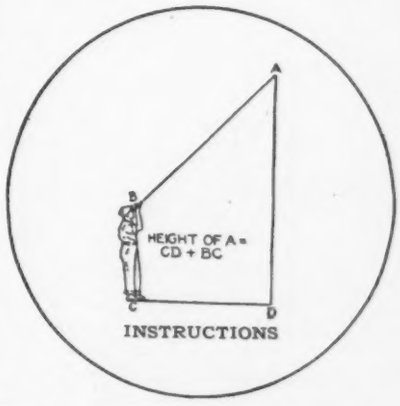
The extra cost of just one wrong guess will pay for one or two Matthews Teleheights. Hundreds of them are saving lots of money for their owners all over the country. Many are being used for quickly figuring the cubical contents of buildings, the clearance of bridges, highlines, etc.

Matthews Teleheight is only five inches long. Has no moving parts. It is furnished with a leather carrying case that will fit in the vest pocket. The drawing below shows how simple are the directions for using it.

Great for Appraisal Jobs.

*Try one at our risk of your approval.*

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.




INSTRUCTIONS

# PROFESSIONAL SERVICES

Consulting
Accounting
Valuations

Management
Appraisals
Construction

Designing
Testing
Financing

Inspections
Cost Analysis
Investigations

## BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

## FORD, BACON & DAVIS, Inc.

ENGINEERS
DESIGN • CONSTRUCTION
VALUATIONS • REPORTS
New York
Philadelphia — Washington — Cleveland — Chicago

## ARTHUR L. MULLERGREN

*Engineering-Management*
*Public Utilities—Natural Gas*

Kansas City, Mo.

## BLACK & VEATCH

*Consulting Engineers*

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

## FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS

35 East Wacker Drive Chicago, Ill.

## Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES

THE ONE-STEP METHOD

*Bill Frequency Analyzer*

102 Maiden Lane New York

## BROADWAY MAINTENANCE CORPORATION

***Light and Power Division***

Design - Construction - Maintenance
Transmission, Distribution and Rural Electric Lines

47-47 35th Street Long Island City, New York

## HENKELS & McCOY

*(Electric & Telephone Line Construction Co.)*

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

## SANDERSON & PORTER

*Engineers*
for the
FINANCING—REORGANIZATION—
DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES

Chicago New York San Francisco

## E. J. CHENEY AND CO.

***Engineers and Consultants***

Design, Supervision of Construction
Rehabilitation Engineering, Reports, Studies
Valuations, Economic and Business Surveys

61 Broadway New York

## HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

## SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

## HUGH L. COOPER & CO.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

101 Park Ave. New York

## WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
*Engineers — Economists*
Public Utility Management Problems
Economic Audits for Selective Load Building
Balanced Domestic Load Development
Cost Analysis—Rate Cases
Noroton, Connecticut

## SPOONER & MERRILL, INC.

*Consulting Engineers*

Design—Supervision of Construction
Reports—Examinations—Valuations

20 North Wacker Drive, Chicago, Illinois

## DAY & ZIMMERMANN, INC.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

## CHAS. T. MAIN, INC.

*Engineers*

Boston, Mass.

Electric, Steam and Hydraulic Projects.
Investigations, Reports, Designs and Appraisals.

## STEVENS & WOOD

Incorporated
ENGINEERS AND CONSTRUCTORS

30 Broad Street New York

## H. F. FERGUSON

*Consulting Electrical Engineer*

Rate Investigations and Comparisons
Plant Surveys—Reports

288 Alameda Avenue Youngstown, Ohio

## J. H. MANNING & COMPANY

ENGINEERING SERVICES

120 BROADWAY NEW YORK FIELD BUILDING CHICAGO

## STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

## ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

## DANIEL W. MEAD F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control. Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

## THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

EVERSTICK ANCHORS...

Provide dependable anchoring when poles are subjected to unusual strains from storms. Made of tough, certified, rust resistant, malleable iron for extra strength and holding power. Write for new bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

G.C.A.
Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

*Send for Catalogue*

*We have been making safety tools for 26 years*

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.



HIGH GRADE HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL PORCELAIN WORKS
TRENTON, NEW JERSEY


## G.E. Employees Receive $95,203 for Suggestions

General Electric Co. in 1941 paid its employees $95,203 for 12,453 suggestions, a large percentage of which were ideas for speeding or improving war production. This amount was 22 percent greater than in 1940 when $77,477 was paid. A total of 40,834 suggestions were turned in last year, 24 percent more than the previous year, and the number accepted was 8 percent larger. Many employees took their awards in defense bonds.

In the past 20 years General Electric has paid employees more than $1,100,000 for suggestions of more efficient ways of doing things. Executives and research men are excluded from the awards.

•

## High-Speed X-ray Gives 300 Kv. in Micro-second

Study of internal strains in rapidly moving parts of machines and motors are potential uses of a new mobile X-ray unit capable of delivering a charge of 300,000 volts in a micro-second, according to Dr. Charles M. Slack of the Westinghouse Lamp Laboratories. Ballistics research, however, is the first application of the new machine, two being utilized to photograph the travel of a bullet through armor plate.

In the new 1,500-lb. unit the high-speed X-rays are generated by a series of six condensers, charged by a high-voltage transformer operating from a conventional 220-volt line. When the condensers are charged to the limit set by central controls, they deliver 2,000 amp. at approximately 300 kv. to the new three-element X-ray tube. In addition to a standard-type anode and an oval-shaped cathode, the tube contains an auxiliary electrode which serves as a trigger to start the discharge of electrons when the tube is activated.

•

## Wins "Minute Man Flag"

Oliver Iron & Steel Corp., Pittsburgh, Pa., and its employees have been presented with the "Minute Man Flag" by the U. S. Treasury Department for attaining more than 90 percent subscription to the payroll deduction plan for purchasing defense bonds. A flag-raising ceremony held at the main plant entrance in South Side Pittsburgh was attended by approximately 1,800 Oliver employees. Morgan R. Kavanaugh, vice-president in charge of production, made an address during the ceremonies.


TONG TEST AMMETERS

**measure both A.C. and D.C. current in the time you take to light a cigarette**

Time, today, is so important that the very welfare of our country depends upon making the most of every minute of every day. Make sure that time lost in your plant due to break-downs caused by current overloads is reduced to a minimum by equipping your maintenance department with TONG TEST AMMETERS.

This compact, 2¾ pound instrument guards against burned-out motors and transformers by making current measuring a simple five seconds job—without breaking the circuit or interrupting operations. With a TONG TEST your men can avoid expensive, time-consuming tie-ups by making daily check-ups of current loads in a fraction of the time required with bulkier, complicated equipment. Most important, TONG TEST is the only ammeter of its type which measures both A.C. and D.C.

Your plant, today, needs a TONG TEST. Once used, you'll agree it's the time-savingest instrument you've ever seen. Get the facts by writing for a copy of the TONG TEST bulletin.

COLUMBIA ELECTRIC MFG. CO.
4529 Hamilton Ave. Cleveland, Ohio

TONG TEST AMMETERS



BURNDY VERSI-TAP

CAN BE USED AS
- PARALLEL TAP
- CROSS CONNECTOR
- END CONNECTOR
- T-CONNECTOR

BURNDY 107 EASTERN BLVD. NEW YORK CITY

# SEARCHLIGHT SECTION

## EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

**UNDISPLAYED RATE:**

10 cents a word, minimum charge $2.00.

(See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.

PROPOSALS, 50 cents a line an insertion.

**INFORMATION:**

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

**DISPLAYED—RATE PER INCH:**

The advertising rate is $7.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. E.W.

*NEW ADVERTISEMENTS received by 10 A. M. April 13th will appear in the April 18th issue subject to limitations of space available.*

### POSITION VACANT

ELECTRICAL FOREMAN for work in large mining organization Chile, South America. Three year contract, transportation both ways and salary while traveling paid by Company. In reply give complete details. P-42, Electrical World, 330 W. 42nd St., New York, N. Y.

### EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 32 years' recognized standing and reputation carries on preliminary negotiations for positions of the calibre indicated above through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVE AND TECHNICAL MEN. Qualified candidate desiring $2,500 to $20,000 position may contact employers through our confidential services, established 26 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

### POSITIONS WANTED

EXPERIENCED POWER PLANT OPERATOR with Steam turbines, hydro-electric and switch board operating power systems and heavy industrial loads. 20 years experience. Best of references. R. S. More, Box 12, Onalaska, Wash.

### POSITIONS WANTED

ELECTRICAL ENGINEER. Twenty years experience in responsible positions as Superintendent of Operation and Maintenance with utilities. Have held present position many years. Satisfactory reason for desiring change. Will consider position any location. Three dependents. Salary desired $350 to $450 based upon opportunity for advancement and relative cost of living. PW-40, Electrical World, 330 W. 42nd Street, New York, N. Y.

MASTER ELECTRICIAN and electrical engineer, 15 years practical industrial wiring installation and maintenance, including several years maintenance of large telephone system. B.S. in E.E.; certificates in telephony and radio; instructor in electricity and radio. Prefer job in South with Oil or industrial company. PW-43, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

**For sale—immediate delivery—**

**. . . the following SMALL MOTORS, new and packed in original factory containers:**

101—G. E. 115 volt, single phase 1140 rpm, ⅛th hp, 60 cycle. Model 5KH45AB32 with bases.

108—G. E. 115 volt, single phase 1140 rpm, ⅛th hp, 60 cycle. Model 5KH45AB32 without bases.

65—G. E. 115 volt, single phase 1140 rpm, ⅛th hp, 60 cycle. Model 5KH45AB449 without bases.

**THE M & M MFG. CO.**
**428 Citizens Nat'l. Bank Bldg.,**
**Independence, Kansas**

**FOR SALE**

**CONDENSING STEAM TURBINE**

1—General Electric, 4 stage, condensing steam turbine, No. 27831 for 175 lbs. steam pressure, direct connected to General Electric 375 K.V.A. Type A.T.B., 3 phase, 3 wire, 2300 volt, 60 cycle generator No. 3868731, complete with 7 K.W. motor driven exciter, size 35, Schutte Koerting Multijet Condenser and 8 inch Cameron 1200 G.P.M. Centrifugal Condenser Water supply pump, motor driven, atmospheric Relief Valve, gauges and thermometers. Price $3500. F.O.B. Cars, Easton, Maryland.

**The Easton Utilities Commission**
**Municipal Building**
**11 SOUTH HARRISON ST., EASTON, MD.**

*Quick ANSWERS to business problems . . .*

MISCELLANEOUS business problems are daily being solved quickly and easily by the use of the Searchlight (classified advertising) Section of this and other McGraw-Hill publications.

When you want additional employees, want to buy or sell used or surplus new equipment, want additional products to manufacture, seek additional capital, or have other business wants—advertise them in the Searchlight Section for quick, profitable results!

American Machinist
Aviation
Business Week
Bus Transportation
Chem. & Met. Eng.
Coal Age
Construction Methods
Electrical Contracting
Electrical Merch.
Electrical World
Electronics
Engineering & Mining Jour.
Engineering News-Record
E. & M. J. Markets
Factory Mgt. & Maintenance
Food Industries
Power
Product Engineering
Textile World
Transit Journal

*Departmental Staff*
**McGraw-Hill Publishing Co., New York**

**For immediate sale**
**OUTDOOR TRANSFORMERS**

3—1000 K.V.A. Single Phase, Westinghouse Outdoor type transformers, 66.6 cycles, 40,000 to 2,400 volts, 50° C rise, impedance 4.8. Taps 39,000 & 38,000, secondary bus disconnecting switches and pipe frame. Transformer serial numbers 66594, 5, 6.

**Hydro Department, Public Utilities Commission, Brantford, Ontario**

**ELECTRICAL POWER CALCULATIONS**

**Practical Solutions On Everyday Problems!**

**AN AID TO LICENSE EXAMS**

For Electrical Engineers—Electricians —Testers—Draftsmen—Plant Superintendents—System Planning Engineers & Operators—Radio Men—Students.

**2 Parts (AC-DC) 25 Chapters**
**425 Pages—289 Illustrations**

SOME OF THE QUESTIONS ANSWERED—HOW to find the Size of Wire required when load, station Voltage & Distance are known. HOW to Calculate the Size of capacitors required for correction of power factor. HOW to Calculate Power by means of two-watt meters. HOW to Calculate the Efficiency of AC Transformers, etc.

**HAVE YOU POWER PROBLEMS? Get this "Answer Book" Just Out! Ask to See It Today! No Obligation.** **$2**

MAIL COUPON TODAY

**AUDEL, Publishers, 49 W. 23rd St., N.Y.**

Mail me postpaid on the terms marked (X) one copy of AUDELS ELECTRICAL POWER CALCULATIONS $2.

☐ WEEK's TRIAL ☐ PAYMENT HEREWITH.

If not satisfied, book to be returned and money refunded.

Name .....

Address .....

Occupation ..... E.W

# WANTED

**—TRANSFORMERS—**

**TRANSFORMERS WANTED**

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

**We Rewind, Repair and Redesign all Makes and Sizes**
**ALL TRANSFORMERS GUARANTEED FOR ONE YEAR**
**Write for Catalog No. 136-A**

**THE ELECTRIC SERVICE CO., INC.**
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
**STATION M** **Since 1912** **CINCINNATI, OHIO**